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Buckley (G. F. H.) & Mortimore (C. G.). **Preliminary Report on the Effect of Spray for Corn Borer Control on Yields of Field Corn.**—*Canad. J. agric. Sci.* **33** no. 3 pp. 288–290, 1 ref. Ottawa, 1953.

The following is based on the authors' abstract. Experiments were carried out in Ontario in 1950 and 1951 on the effect of sprays applied against the European corn borer [*Pyrausta nubilalis* (Hb.)] on yields of shelled maize. The earliest applications were made when there were 50 egg-masses per 100 plants, and the others either one or two weeks later. In 1950, when the spray used was 1·66 lb. 15 per cent. parathion per 100 gals., two applications, made on the first and last dates, resulted in an average increase in yield of 8·9 bushels per acre. In 1951, when 2 lb. 50 per cent. wettable DDT per 100 gals. was substituted, single applications on the first or second spraying date were followed by average increases of 13·9 and 17·1 bushels, respectively, and two applications on the first and last spraying dates by an average increase of 16·6 bushels. It is concluded that one application made 7–10 days after the number of egg-masses per 100 plants reaches 50 is as effective in increasing yields as two.

Box (H. E.). **Informe preliminar sobre los taladradores de la caña de azúcar** (*Diatraea* **spp.**) **en Venezuela.** [A preliminary Account of the Sugar-cane Borers (*Diatraea* spp.) in Venezuela.]—*Bol. téc. Inst. nac. Agric. Venez.* no. 2, 72 pp., 19 pls., 16 pp. refs. Maracay, 1952. **Investigaciones sobre los taladradores de la caña de azúcar** (*Diatraea* **spp.**) **en Venezuela. Informe del progreso durante 1947–1949.** [Investigations on the Sugar-cane Borers (*Diatraea* spp.) in Venezuela. Progress Report for 1947–49.]—*Op. cit.* no. 3, 39 pp., 1 pl., 2 maps (1 fldg.), 18 refs. 1952. **Investigaciones sobre los taladradores de la caña de azúcar** (*Diatraea* **spp.**) **en Venezuela. El proyecto del combate biológico. Informe del progreso durante 1949–1951.** [Investigations on the Sugar-cane Borers (*Diatraea* spp.) in Venezuela. The Project of Biological Control. Progress Report for 1949–51.]—*Op. cit.* no. 5, 52 pp., 14 pls., 1 graph, 1 fldg. table. 1952. (With Summaries in English.)

The first two of these bulletins are reprints of papers already noticed [*R.A.E.*, A **37** 273; **39** 92]. In the third, the author gives lists of the food-plants and indigenous parasites of the species of *Diatraea* that occur in Venezuela, a list of those that attack sugar-cane there [*cf.* **40** 3, etc.], a chart showing the degree of infestation by them in various States, and notes on the distribution and host relations of the Tachinids, *Paratheresia claripalpis* (Wulp.), *Leskiopalpus diadema* (Wied.), *Zenillia (Palpozenillia) palpalis* Aldr., and *Jaynesleskia jaynesi* (Aldr.), which are the four native parasites considered of practical importance. The last was found in February 1950 parasitising *Diatraea* on a wild grass and is the only one not yet reared from the larvae on sugar-cane in Venezuela, though it parasitises *D. saccharalis* (F.) on that crop in Tucumán, Argentina [*cf.* **22** 595, etc.]. In work on introduced species and races of parasites begun in 1950, stocks of *P. claripalpis* were received from Trinidad, Mexico and Peru, the Amazon race of *Metagonistylum minense* Tns. from Trinidad, and the São Paulo race of *M. minense* indirectly from São Paulo. The way in which these were reared on *Diatraea* spp. is described. The various races of each species were crossed, the results being given in detail in tables, and a hybrid stock from the cross between the Venezuelan and Trinidad races of *P. claripalpis* was obtained that appeared promising for local use. Adults from this stock were liberated near Maracay and in Carabobo in sugar-cane fields

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infested mainly by *D. rosa* Heinr., and small numbers of the three introduced races were also released. Increases in the natural populations of *Paratheresia* occurred in localities where this was done, and these probably resulted from successful but temporary establishment of the foreign races. *Metagonistylum* was liberated in various States, and evidence of permanent establishment was obtained at two widely separated localities in Aragua and Yaracuy.

Kennington (G. S.). **The Effects of reduced Atmospheric Pressure on Populations of** *Tribolium castaneum* **and** *Tribolium confusum*. — *Physiol. Zoöl.* **26** no. 2 pp. 179–203, 7 figs., 19 refs. Chicago, Ill., 1953.

The following is virtually the author's summary. Laboratory populations of *Tribolium castaneum* (Hbst.) and *T. confusum* Duv. were exposed continuously in pressure chambers, except for censusing, to three different barometric pressures—one identical with that at Chicago (altitude about 600 ft.), a second simulating 8,000 ft. altitude, and a third simulating 14,000 ft. altitude—for a period of 660 days.

Both species were affected by reduced atmospheric pressure when tested as single individuals and as populations. As individuals, *T. confusum* appeared to be favoured in a majority of the measured responses, but as a population it was deficient, both as a competitor and as a single species. The pattern of competition between the two species was essentially unchanged by lower barometric pressures, except for the tendency of *T. confusum* to persist in low numbers longer in the common culture. The decline in numbers and total weight was proportional to the reduction in atmospheric pressure, and no demonstrable tendency to become adapted to low pressures was detected.

Cohic (F.). **Les insectes nuisibles aux plantes cultivées dans les Wallis et Futuna.**—*Agron. trop.* **5** no. 11–12 pp. 563–581, 8 figs. Nogent-sur-Marne, 1950. Also as **Insect Pests in the Wallis Islands and Futuna.**—*Tech. Pap. S. Pacif. Comm.* no. 8, [3 +] 25 pp. Nouméa, 1950.

This report is based on a stay of 12 days in Wallis Island and three days in Futuna. In Wallis Island, coconut is the only export crop. The plantations are old, neglected and overgrown with bush and severely attacked by pests and diseases. The main pest is *Oryctes rhinoceros* (L.), which appeared in 1931 and now occurs throughout the island. It apparently develops uninterruptedly, all stages being present together, and is free from natural enemies. Damage was severe, but export has so far not been reduced. The usual methods of control and the enforcement of measures to prevent the spread of the beetle to Futuna are recommended [*cf. R.A.E.*, A **42** 104]. Other pests of coconut on Wallis Island included *Promecotheca reichei* Baly, which was found on most of the palms but appeared to be controlled by native parasites, including the Trichogrammatid egg-parasite, *Oligosita utilis* Kowalski; *Diocalandra taitensis* (Guér.), which attacked the basal roots but was not common; a species of *Agonoxena*, probably *A. argaula* Meyr., which feeds on the leaflets and was apparently controlled by a Chalcidoid parasite; the Phasmid, *Graeffea crouanii* (Le Guillou) (*cocophaga* (Newp.)), which makes deep cuts in the leaflets; and *Pinnaspis minor* (Mask.) and a mealybug, which were of little importance. Banana is grown in the coconut plantations, a practice that

should be discontinued, and is severely attacked by *Nacoleia octasema* (Meyr.), which can be controlled by dusting with pyrethrum or 5 per cent. DDT when the bracts begin to separate, and by *Cosmopolites sordidus* (Germ.), against which the usual measures are recommended. *Plaesius javanus* Erichson, a natural enemy of *C. sordidus*, was introduced in 1947 for the control of *O. rhinoceros*, against which it is ineffective, and does not appear to have become established. A fresh introduction against *C. sordidus* is desirable. *Epilachna vigintioctopunctata* (F.), which also injured egg-plant [*Solanum melongena*] and tomato, occasionally attacked banana; it can be controlled by spraying with copper arsenate. Symptoms of bunchy top were observed, but *Pentalonia nigronervosa* Coq., the Aphid that transmits the causal virus, was not found. Other pests observed included *Tarophagus proserpina* (Kirk.) on taro (*Colocasia esculenta*), *Peregrinus maidis* (Ashm.) and *Aphis maidis* Fitch on maize, *Aulacophora similis* (Ol.) on melon, *Hymenia recurvalis* (F.) on beet, *Gnorimoschema heliopa* (Lower) on tobacco and *Unaspis* (*Prontaspis*) *citri* (Comst.) on orange.

The pests observed on Futuna included the six species other than *Oryctes* recorded from Wallis Island on coconut, *N. octasema* and a mealybug on banana, *T. proserpina* on taro, and *Mictis profana* F. on shoots of orange. Oranges were damaged by the fruit-piercing moth, *Othreis fullonia* (Cl.) (*Ophideres fullonica* (L.)), which develops on *Erythrina* and could be eradicated if necessary by destroying the few *Erythrina* trees introduced.

Dumbleton (L. J.). **Rhinoceros Beetle in the Kingdom of Tonga. A Report on a Visit to Vavau in August, 1952.**—*Tech. Pap. S. Pacif. Comm.* no. 34, [1+] 6 pp., multigraph. Noumea, 1952.

Oryctes rhinoceros (L.), which had previously appeared on coconut in Tonga on Keppel Island in 1922 and been eradicated by 1929, was found there on Vavau in February 1952, having possibly been introduced in decayed wood from Samoa in the previous July. The infested area extended over about one square mile in early April and 3–4 square miles in August, reached 300–400 ft. above sea level in places and included town and village districts and nursery gardens as well as coconut groves, many of which were irregularly planted and carried a heavy undergrowth of scrub and weeds. The control measures adopted comprised the elimination of actual and potential breeding sites, the collection of larvae and adults and the use of trap-logs, and recommendations for intensifying the campaign are made.

Day (M. F.) & Irzykiewicz (H.). **Feeding Behaviour of the Aphids *Myzus persicae* and *Brevicoryne brassicae*, studied with Radiophosphorus.**—*Aust. J. biol. Sci.* **6** no. 1 pp. 98–108, 2 figs., 14 refs. Melbourne, 1953.

The following is based largely on the authors' summary. The volume of material ingested and excreted by *Myzus persicae* (Sulz.) and *Brevicoryne brassicae* (L.) was measured by feeding apterae on sucrose solutions containing radioactive phosphorus as disodium hydrogen phosphate or sodium dihydrogen phosphate through a plastic membrane or on isolated leaves of Chinese cabbage (*Brassica chinensis*) standing in a solution containing it. No uptake could be detected within the first few minutes of penetration by the stylets. *Myzus* ingested approximately 0·07 mg. plant material in one hour, and *Brevicoryne* less than one-twentieth of that amount in the same

period. No artificial diet was found that was ingested by *Myzus* as readily as leaf tissue, and less was ingested from the upper than from the lower surface of a leaf. Excretion was found to be variable and discontinuous. Both species ejected during a subsequent feed a fraction of 1 per cent. of the radioactive phosphorus ingested. No evidence was obtained for the occurrence of regurgitation from the midgut, and it is probable that ejection occurred with the saliva. Periods of starvation of 30–240 minutes did not affect the amount subsequently ingested by *Myzus* during a 30-minute feeding period. The volume of liquid mechanically transported on the stylets of *Myzus* was about 2×10^{-7} ml.

The results are discussed with reference to those obtained by other workers with *M. persicae* [*cf. R.A.E.*, A **23** 494] and *Orosius argentatus* (Evans) [**41** 404] and to the mechanism by which Aphids transmit plant viruses. Non-persistent viruses can be transmitted within a feeding period of two minutes, but in the present work no ingestion occurred so soon after insertion of the stylets. Short periods of starvation increase the amount ingested by *Orosius* [**41** 405], but not by *Myzus*. The long feeding period required for the latter to ingest enough material for accurate measurement may vitiate the effects of starvation, but it seems likely that the effect of starvation on the ability of Aphids to transmit non-persistent viruses may be due to factors other than the amount subsequently ingested.

Powning (R. F.). **Studies on the Digestion of Wool by Insects. VIII. The Significance of certain excretory Products of the Clothes Moth,** *Tineola bisselliella*, **and the Carpet Beetle,** *Attagenus piceus*.—*Aust. J. biol. Sci.* **6** no. 1 pp. 109–117, 45 refs. Melbourne, 1953.

Waterhouse (D. F.). **IX. Some Features of Digestion in Chewing Lice (Mallophaga) from Bird and mammalian Hosts.**—*T.c.* no. 2 pp. 257–275, 2 pls., 5 figs., 37 refs.

The following is based on the author's summary of the first of these two parts of a series [*cf. R.A.E.*, A **42** 139, etc.]. The excreta of larvae of *Tineola bisselliella* (Humm.) feeding on a standard undyed woollen fabric, adults of *Attagenus piceus* (Ol.) on wool, and larvae of *Gnorimoschema operculella* (Zell.) on potato tubers were analysed. Water-soluble nitrogen constituted most of the total nitrogen in the excreta of *Tineola* and *Attagenus*. The fraction of this water-soluble nitrogen contributed by uric acid or its salts was high in *Tineola*, but considerably lower in *Attagenus*. Up to 3 per cent. urea and an appreciable quantity of ammonia were also present. Small quantities of urea (0·14 per cent.) were found in the dissected mid-guts of larvae of *Tineola* feeding on wool, whereas none was found in several insects that do not feed on keratin. This percentage was too small to be of significance in the digestion of wool through any direct denaturing action on keratin. In *Tineola*, the sulphur of wool was excreted mainly as cystine and not to any large extent as inorganic sulphate or sulphur dioxide, both of which have been suggested as possible metabolic products. *Attagenus* excreted almost twice as much cystine as *Tineola* on a similar diet. Lanthionine, which is possibly produced when wool is treated with alkalis, was not found in excreta of *Tineola*. Larvae of the latter fed on wool treated with nickel salts excreted black faecal pellets having a much reduced cystine content. It is suggested that the cystine is broken down (probably enzymatically) to yield sulphur for the formation of nickel sulphide.

In the second paper, some aspects of digestion in eight species of Mallophaga that infest birds and mammals are examined. Neither hair nor

wool could be regularly detected in the digestive tract of the mammal-infesting species. Free sulphydryl groups could not be detected in the sheep louse, *Damalinia ovis* (Schr.), and it is doubtful whether wool could be digested by it.

MILLER (L. W.). **Laboratory Observations on the Biology of the European Red Mite, *Paratetranychus pilosus* (C. & F.) in Tasmania.**—*Tasm. J. Agric.* **24** no. 1 pp. 20–30, 2 figs., 13 refs. Hobart, 1953. **Biology of the Red Spider Mite. Corrigendum.**—*T. c.* no. 2 p. 124.

Further laboratory studies on the bionomics of *Paratetranychus pilosus* (C. & F.) on apple were made in Tasmania during 1949–52, and the data obtained, with those from earlier experiments in 1948–49 [*R.A.E.*, A **41** 123] are given and discussed. The mites were confined on the leaves by means of small celluloid cylinders closed with a tight-fitting cork, of which the centre was replaced by fine muslin. The durations of the egg, larval and two nymphal stages at room temperatures are given in tables and did not differ substantially in the three years [*cf. loc. cit.*]. Females developed rather more slowly than males. They apparently mated only once, and eggs laid by females that did not pair gave rise to males. There was virtually no difference in the rate of development on two varieties of apple differing in susceptibility to attack, but it was significantly slower, especially in the second nymphal stage, on foliage already severely damaged by mites. At constant temperatures of 70, 75 and 80°F., total development averaged 16·8, 12·9 and 11·1 days, respectively; it was slightly slower at a constant temperature of 70°F. than at fluctuating temperatures averaging about the same figure. The preoviposition and oviposition periods averaged about two and 18·5 days, respectively, at the fluctuating temperature, and the females survived for an average of 21 days. The daily oviposition rate reached a peak after six days and remained high, though with fairly wide fluctuations, for 17 days, and there were great individual variations in the total numbers of eggs laid. The average and (in brackets) the maximum numbers laid per female in 1949–50 and 1951–52 were 64·2 (140) and 55·7 (153), respectively, which are considerably greater than the numbers recorded in other countries [*cf.* **36** 375; **40** 141]. Neither the mean number of eggs nor the survival period of the adult females varied greatly at constant temperatures of 70 and 75°F., but both were significantly less at 80°F. There was no significant difference between the numbers of eggs laid on the susceptible and less susceptible varieties. Oviposition did not appear to be directly stimulated when the mites were confined on leaves sprayed with 0·2 per cent. DDT, but there may be an indirect effect if DDT influences the physiology of the tree [*cf.* **39** 237]. In a test carried out late in the season, more females laid winter eggs when reared on foliage already damaged by mites than on undamaged leaves.

MILLER (L. W.) & HUDSON (N. M.). **Biological Control of Pests of Crucifers in Tasmania.**—*Tasm. J. Agric.* **24** no. 2 pp. 125–131, 3 figs., 5 refs. Hobart, 1953.

Pieris rapae (L.), *Plutella maculipennis* (Curt.) and *Brevicoryne brassicae* (L.) are the main pests of cruciferous crops in Tasmania, and as the use of insecticides is undesirable on those grown for forage, control is being attempted by means of parasites [*cf. R.A.E.*, A **36** 70; **38** 455; **39** 39]. Those introduced against *Pieris* are *Pteromalus puparum* (L.), which is established in all the areas concerned and affords some measure of control,

Apanteles rubecula Marsh., which, following an unsuccessful attempt in 1943, was re-introduced in 1951, from Canberra, but is not known to be established in any of the four localities in which it was released, and *A. glomeratus* (L.), which has been liberated in 23 localities, is now established in most areas and, owing to its rapid rate of natural dispersion, is likely soon to be established throughout the State. The parasites introduced against *Plutella* are *Angitia cerophaga* (Grav.) and *Thyraeella collaris* (Grav.), which are established over fairly extensive areas, and *A. tibialis* (Grav.), which was introduced from Canberra early in 1952 and liberated in three places. *Hymenobosmina rapi* (Cam.), which was described from New South Wales and is believed to be indigenous, is widespread and, apart from the introduced species, the only common parasite of *P. maculipennis*. Two unspecified Braconids attack *B. brassicae* in Tasmania, but little is known of their habits or status. Notes are included on the bionomics of the pests and of most of the named parasites.

Ankersmit (G. W.). **Bestrijdingsproeven tegen de katoenboorder** *Earias fabia* **Stoll. (Lepidoptera, Noctuidae).** [Experiments on the Control of *E. fabia*.]—*Contr. gen. agric. Res. Sta. Bogor* no. 126, 19 pp., 3 figs., 3 refs. Bogor, 1951. (With Summaries in Indonesian and English.)

The following is based mainly on the author's summary. *Earias fabia* (Stoll) is one of the principal pests of cotton in Java, and has also been reported from Sumatra and New Guinea. In observations in Java, eggs were deposited at night near the shoots or young bolls or on the sepals. The larvae hatched in 3–4 days and entered the plants after a further day. They became full-fed in 16–17 days in the shoots, 10 days in the flowers or about 12 days in the bolls. Pupation took place on the plant, and the pupal stage lasted 8–9 days [*cf. R.A.E.*, A **26** 766]. The adults lived for 8–23 days, and up to 357 eggs were deposited per female.

The cultural control measures recommended comprise the destruction of wild food-plants, growing cotton as an annual crop, and planting large areas at the same time, so that opportunities for continuous increase are limited. In experiments on chemical control in East Java in 1949, treatments were applied 15 times at weekly intervals from July to October. Dusting with a 6:1 mixture of talc and derris containing 13·6 per cent. rotenone reduced infestation to about a third of that in the controls and gave a corresponding increase in the yield of undamaged seed and lint. BHC and DDT in 5 per cent. dusts or 0·1 per cent. sprays were ineffective. Derris also controlled the mite, *Tetranychus bimaculatus* Harvey, which was favoured by DDT. Similar results were obtained with treatments applied seven times at intervals of a fortnight from the time infestation began until six weeks before picking ceased, and the superiority of derris over DDT was confirmed in further experiments at Bogor in 1950, when toxaphene was also tested in a dust and spray and gave slightly better control than DDT. None of these materials was effective against *Phenacoccus hirsutus* Green.

Ankersmit (G. W.). **Life History and Control of the Soya Bean Leaf Beetle** *Phaedonia inclusa* **(Stål) (Coleoptera, Chrysomelidae).**—*Contr. gen. agric. Res. Sta. Bogor* no. 129, 34 pp., 5 figs., 4 refs. Bogor, 1952. (With a Summary in Indonesian.)

In view of serious injury to soy beans in Central and East Java by *Phaedonia inclusa* (Stål), investigations on its bionomics and control were undertaken in the field there and in the laboratory at Bogor (West Java),

mainly in 1949–50. All stages of the Chrysomelid are briefly described, its distribution is reviewed [*cf. R.A.E.*, A **41** 232] and a list of its food-plants is given. The most important of the latter are soy beans and *Desmodium* spp. Eggs were deposited in batches of about 5–12 on the lower surfaces of leaves that had just reached full development. The larvae hatched in four days and migrated a few days later to the top shoots, flowers and pods, on which they fed. The duration of the larval stage varied somewhat with the food-plant and averaged about 12 days on soy beans. Pupation occurred in an earthen cell in the soil, the pupal stage lasting about four days. Adults were found on all the upper parts of the plants, but sheltered from strong sunlight in cracks in the soil, under clods or in rice stubble in the fields. When supplied with food in the laboratory, they usually died within 3–4 months, but some lived for almost seven months, and evidence was obtained of survival in the field for three months without food. Flight is apparently uncommon, but was induced in the laboratory by exposure to sunlight. Dispersion is thus apparently largely passive, the beetles being transported in soy-bean straw, fodder, etc. Females predominated in East Java on soy bean and males at Bogor on *D. ovalifolium*. Oviposition began 4–15 days after emergence and continued at a fairly even rate for 34–97 days. In breeding tests on soy bean in 1930 and 1949, the numbers of eggs laid per female averaged 175 and 225, the greatest numbers being obtained from females that fed on young leaves. Fewer eggs were laid on *Pueraria*. Experiments on the relation of the beetle to its various food-plants in Java are recorded [*cf. loc. cit.*]. In laboratory studies on the effect of humidity, eggs failed to hatch at relative humidities not exceeding 55 per cent., the optimum being 80 per cent., and free water was detrimental to pupae not protected by their earthen cells.

Serious outbreaks of *Phaedonia inclusa* are unlikely if a crop rotation is adopted that leaves the fields free from soy beans or other food-plants for eight months of the year and planting is simultaneous over a large area. In tests on chemical control, dusts of 5 per cent. BHC, DDT or toxaphene and sprays of 0·1 per cent. wettable BHC or toxaphene, applied twice at an interval of a week or more, gave excellent control of the larvae and greatly reduced the numbers of adults; a spray of 0·1 per cent. wettable DDT was less effective against the latter.

Freeman (T. N.). **The Spruce Budworm, *Choristoneura fumiferana* (Clem.) and an allied new Species on Pine (Lepidoptera: Tortricidae).**—*Canad. Ent.* **85** no. 4 pp. 121–127, 22 figs. (18 col.). Ottawa, 1953.

MacKay (M. R.). **The Larvae of *Choristoneura fumiferana* (Clem.) and *C. pinus* Free. (Lepidoptera: Tortricidae).**—*T.c.* pp. 128–133, 14 figs., 2 refs. **Erratum.**—*Op. cit.* **86** no. 2 p. 77. 1954.

Campbell (I. M.). **Morphological Differences between the Pupae and the Egg Clusters of *Choristoneura fumiferana* (Clem.) and *C. pinus* Free. (Lepidoptera: Tortricidae).**—*Op. cit.* **85** no. 4 pp. 134–135, 2 figs. (1 col.). 1953.

Cox (C. E.). **Analysis of Frequency Distribution of Adults and Larvae of *Choristoneura fumiferana* (Clem.) and *C. pinus* Free. (Lepidoptera: Tortricidae).**—*T.c.* pp. 136–141, 4 graphs, 3 refs.

Smith (S. G.). **Reproductive Isolation and the Integrity of two sympatric Species of *Choristoneura* (Lepidoptera: Tortricidae).**—*T.c.* pp. 141–151, 1 fig., 10 refs.

In the first of these papers, the Tortricid hitherto referred to as the jack-pine budworm or the form of *Choristoneura fumiferana* (Clem.) that attacks

Pinus banksiana [*R.A.E.*, A **32** 178; **39** 1] is described from adults of both sexes as *C. pinus*, sp.n., and information is given on its taxonomy, distribution and food-plants, together with characters separating it from *C. fumiferana*, a description of which is also included, and some other closely-related forms [*cf.* **33** 314]. *C. pinus* is recorded from Nova Scotia, Ontario, Manitoba and Michigan. It attacks *Pinus* spp., notably *P. banksiana* and *P. resinosa*, and rarely species of spruce (*Picea*), and flies about a fortnight later than *C. fumiferana* [*cf.* **32** 178]. *C. fumiferana* occurs from Virginia north to Labrador, west across Canada and northern United States to British Columbia, south in the Cordilleran region to Arizona and California, and north to the Yukon; it feeds on spruce and balsam fir [*Abies*] and, more rarely, on larch [*Larix*] and pine [*cf.* **32** 179].

The second paper contains descriptions of the second- and last-instar larvae of *C. fumiferana* and of the last-instar larva of *C. pinus*, and a discussion of characters separating the larvae of the two species in various instars. The most important of these is the postclypeal index, obtained by dividing the length of the median dorsal line from the anterior edge of the postclypeus to the termination of the adfrontals by the width of the postclypeus, and its reliability and the significance of anatomical differences in the adults and larvae of the two species are examined statistically in the fourth paper. Characters differentiating the pupae and egg clusters are given in the third.

The following is the author's summary of the fifth paper. Introgressive hybridisation between sympatric populations of *C. fumiferana* and *C. pinus* is shown to be prevented in nature by reproductive isolation. This is a co-operative complex with ecological, temporal and sexual components: the first is primarily a matter of host-tree preferences; the second obtains through interspecific differences in time of emergence from diapause (phenological isolation) and in rate of subsequent development (ontogenetic isolation); the third is conditioned by an innate repugnance to cross-mating expressed solely by females of both species, which is reinforced by their reluctance to deviate from a differential in mating hour. Experiments proved that the sex-linked, species-specific development rates and the inherent tendency for males to eclose before females furnish artificially-produced reciprocal hybrids with different capacities for inbreeding. Therefore, although it is concluded that the integrity of the two species is fully maintained in nature, were reproductive isolation to break down, it is the hybrid type with the better theoretical chance of materialising that would suffer more from sexual differences in eclosion time. As a consequence, new gene arrays would be strictly limited in number and largely siphoned back into, and swamped by, the gene pools of the parental populations.

Walley (G. S.). **Hymenopterous Parasites of *Choristoneura pinus* Free. (Lepidoptera: Tortricidae) in Canada.**—*Canad. Ent.* **85** no. 4 p. 152. Ottawa, 1953.

Lists are given of the Hymenopterous parasites reared from 116 full-fed larvae and pupae of *Choristoneura pinus* Freeman [*cf.* preceding abstract] collected on *Pinus banksiana* in Ontario and from 456 pupae collected in Manitoba, also on *P. banksiana*, both in July 1951. The 41 parasites obtained from the Ontario material comprised the Braconid, *Meteorus trachynotus* Vier., the Pteromalid, *Habrocytus phycidis* Ashm., a species of *Eurytoma* closely related to *E. atripes* Gah., the Chalcid, *Brachymeria ovata* (Say), another Chalcid closely related to *Spilochalcis sanguiniventris* (Cress.), and the Ichneumonids, *Ephialtes* (*Scambus*) *hispae* (Harris), *E.*

(*Calliephialtes*) *comstockii* Cress., *Apechthis ontario* (Cress.), *Itoplectis conquisitor* (Say), and *Hemiteles* (*Gelis*) *tenellus* (Say). The 75 from Manitoba comprised the Ichneumonids, *A. ontario*, *I. conquisitor*, *Phaeogenes hariolus* (Cress.), *Glypta fumiferanae* (Vier.) and *Campoplex hyalinus* (Prov.). Many of these have previously been recorded from *Choristoneura fumiferana* (Clem.).

Graham (K.) & Prebble (M. L.). **Studies of the Lecanium Scale, *Eulecanium coryli* (L.), and its Parasite, *Blastothrix sericea* (Dalm.), in British Columbia.**—*Canad. Ent.* **85** no. 5 pp. 153–181, 4 graphs, 22 refs. Ottawa, 1953.

The Encyrtid, *Blastothrix sericea* (Dalm.), was introduced into British Columbia in 1928–29 for the control of *Eulecanium coryli* (L.) [*R.A.E.*, A **20** 67], and populations of the Coccid were light during subsequent years [**21** 614; **24** 246], though some extension of the infested area was noted. However, a survey during 1941–45 established that infestations of variable intensity extended eastward for about 50 miles from the original focus and also occurred in Vancouver Island. During the survey, the seasonal development of both Coccid and parasite and their interrelations were investigated. *B. sericea* was the only parasite of *E. coryli* recovered, and it was found in all the populations sampled. Eggs of *E. coryli* were observed to hatch only during the latter half of June [*cf.* **14** 174]. Nymphal mortality due to causes other than parasitism reached 8–16 per cent. in late summer and 0·5–44·1 per cent. during winter. A variable proportion of the nymphs remained retarded in development throughout February–June, and there appeared to be some relation between the percentage that did not develop and the food-plant; plum was the most favourable for development, and lime [*Tilia*], horse chestnut [*Aesculus hippocastanum*] and maple [*Acer*] least. Females comprised 60–68 per cent. of the population, and 19–34 per cent. of them failed to oviposit, apparently owing to lack of fertilisation.

B. sericea has two generations a year. Eggs appear to be deposited in host nymphs on the foliage and twigs from shortly before mid-September until after early October, but not later than early December. Most of the resulting larvae hatched in January–February, pupae were present from early March till the third week in April, and adults emerged during the last three weeks of April. First-generation eggs were deposited during May, mostly in actively developing females. First-generation adults usually emerged in the second half of June. Females comprised about 65 per cent. of the adults reared from host nymphs and 76 per cent. of those from mature females. The parasite appeared not to be associated with *E. coryli* between June and September; it was reared from Coccids tentatively determined as *Physokermes* sp. on Douglas fir [*Pseudotsuga taxifolia*], though fully grown females of *E. coryli* were available at the time.

Parasite eggs laid in the host nymphs during autumn were usually distributed at random, though there was a tendency towards underdispersion. The highest percentage parasitism was 89, and it is unlikely that higher proportions would be parasitised. The average density of parasite eggs per nymph was inversely related to the number of nymphs per sample unit, comprising a 12-inch length of twig; nymphal populations showed considerable variation and were highest on lime, ornamental plum, elm, horse chestnut and apple. The percentage hatch averaged 77 in nymphs with a single parasite egg and declined to an average of 40 in those with four or more eggs. Nevertheless, the percentage of nymphs in which

at least one parasite egg hatched was relatively constant at 74–80, regardless of the number of eggs that they contained. The distribution of the first-generation eggs among the maturing host females in April–May was not studied, but full-fed larvae and pupae of this generation were distributed at random in most of the samples; there was a tendency towards over-dispersion in non-random samples. The density of mature parasites per host female varied inversely with the density of the latter, and was greatest (at least 3·5) where there were not more than five host females per 12-inch twig. Population data obtained from representative sampling points during 1942–45 indicated that parasitism by *Blastothrix*, though frequently quite high, usually killed only about half the parasitised nymphs. Winter mortality and underdevelopment were in most cases equal to or more important than the parasite in limiting the host populations. The rate of parasite increase between the time of emergence of the adults from the host females in June and oviposition in autumn was usually low, and in some cases the population declined. This long dissociation of the parasite from the host during summer seemed seriously to limit its effectiveness.

Pielou (D. P.) & Glasser (R. F.). **Survival of *Macrocentrus ancylivorus* Roh., a Parasite of the Oriental Fruit Moth, on different Concentrations of various Sugar Solutions.**—*Canad. J. Zool.* **31** no. 2 pp. 121–124, 1 graph, 6 refs. Ottawa, 1953.

The following is substantially the authors' abstract. Newly emerged adults of *Macrocentrus ancylivorus* Rohw. were fed throughout life on solutions of dextrose, laevulose, galactose, maltose, sucrose and lactose, at seven concentrations ranging from 0·1 to 40 per cent. The sexes were kept separate, and the temperature remained constant at 26·5°C. [79·7°F.]. The mean length of life on lactose at any concentration only slightly exceeded that on water. Survival was moderate on galactose and satisfactory on the remaining four sugars, on which it increased rapidly with concentration and reached a maximum at 5 per cent. It declined at higher concentrations, especially at 20 and 40 per cent., but was greater at 40 than at 2·5 per cent. Survival on 10 per cent. honey was less than on any of these four at the same concentration. The mean survival period of males was in general slightly shorter than that of females.

Bird (F. T.). **The Effect of Metamorphosis on the Multiplication of an Insect Virus.**—*Canad. J. Zool.* **31** no. 3 pp. 300–303, 4 pls., 7 refs. Ottawa, 1953.

Preliminary studies on the polyhedral virus disease that attacks the European spruce sawfly, *Gilpinia* (*Diprion*) *hercyniae* (Htg.), in Canada indicated that the larvae become immune or resistant to infection shortly after constructing their cocoons [*cf. R.A.E.*, A **33** 399]. The histological and cytological changes associated with moulting and pupation were accordingly investigated to determine their effect on the multiplication of the virus, which occurs only in the nuclei of the digestive cells of the mid-gut epithelium. It was found that the temporary, prepupal mid-gut is composed entirely of embryonic cells, which are not susceptible to infection. Large masses of disintegrated digestive cells, which accumulate in infected areas of the larval mid-gut, remain in the lumen and rapidly infect the new digestive cells that develop from the embryonic cells in the pupal and adult stages.

Fahey (J. E.), Brindley (T. A.) & Rusk (H. W.). **Three Years' Study of DDT Residues on Corn Plants treated for European Corn Borer Control.**—*Iowa St. Coll. J. Sci.* **28** no. 2 pp. 209–260, 16 figs., 15 refs. Ames, Iowa, 1953. **Studies of DDT Residues on Corn.**—*Agric. Chem.* **9** no. 3 pp. 50–51, 53, 135–137, 2 figs., 11 refs. Baltimore, Md., 1954.

The second of these papers is a shortened version of the first, and the following is based largely on the authors' summary of the latter. Investigations on DDT residues left on maize plants by treatments for the control of *Pyrausta nubilalis* (Hb.) were carried out in Ohio and Indiana in 1949 and in Iowa in 1950 and 1951. In tests of the effect of spray volume, spray pressure and nozzle arrangement on deposition and distribution, the DDT was applied at 1·5 lb. in 2·5–80 U.S. gals. spray per acre at pressures of 20–160 lb. per square inch. Maximum deposits were obtained at 2·5 U.S. gals. per acre, indicating that there was not sufficient moisture to wet any part of the plant to run-off. The distribution of the DDT on the plant parts was much improved at 20 and 40 U.S. gals. per acre, with indications that the entire plant was thoroughly wet with spray, and there was excessive wetting and run-off at 80 U.S. gals. per acre. Residues were greatest at the lowest spray pressure tested, but the differences were small and it is improbable that they would have caused significant differences in insect control. Appreciably more insecticide was deposited in the plant whorl by 80° flat-fan nozzles, used singly or in pairs, than by two or three 65° flat-fan nozzles over the row, and single hollow-cone nozzles deposited less than either of the flat ones. All nozzle arrangements resulted in heavy residues on the leaves, with no appreciable differences in the residues on the plant stalk, but more insecticide was deposited in the whorl when all nozzles were over the row than when some were at the sides.

Dusts, at 2 lb. actual DDT per acre, gave lower deposits than sprays, and suspension sprays lower ones than emulsion sprays. The deposits from emulsion sprays were the most persistent. Lower deposits were obtained from an emulsion spray applied from the air than from the ground, and aeroplane application of a dust resulted in an uneven distribution, with excessive dust on the middle rows and little or none on the outer ones. Deposits were greater from dusts applied at night when there was dew on the plants than from those applied by day when the plants were dry; day and night application of sprays resulted in no difference in deposit.

When used for the control of the second generation of *P. nubilalis* on maize for canning, three dust applications left residues of about 13 parts per million and spray applications 29–41 p.p.m. at harvest. The silage from plants bearing a residue of 41 p.p.m. contained 12–34 p.p.m. DDT, and the milk from cows fed on it contained 0·6–3·8 p.p.m. Young plants, in which the ratio of height to weight is high, retained larger residues than older ones in which this ratio is low and the plant surface less permeable. The effect of plant-growth dilution was greater during the period of rapid development than after the plants had completed most of their growth. During the first 14 days of weathering, deposits from suspension sprays showed a greater loss than those from emulsion sprays.

Residues will not exceed 0·1 p.p.m. of DDT on plants used for silage or stover feeding, if suspension sprays are applied once before the plants reach a height of 60 ins., or twice at an interval of one week before they reach 44 ins., or if emulsion sprays are applied once or twice before the plants are 35 ins. high. Maize kernels collected at harvest from plots that had been sprayed twice with DDT at the rate of 1·5 lb. per acre when the plants were 12·5–72 ins. high showed no DDT either on the surface or internally.

Yeoman (A. H.) & Van Leeuven [*i.e.* Leeuwen] (E. R.). **Explosion Characteristics of insecticidal Aerosols.**—*Agric. Chem.* **9** no. 4 pp. 75, 77, 2 refs. Baltimore, Md., 1954.

The widespread use of large generators to apply insecticidal aerosols indoors in the United States during the last six years has resulted in serious accidents in which buildings of various kinds have been destroyed by explosions, and the explosiveness of various solvents and oils commonly used in aerosol formulations was therefore tested under conditions as close as possible to those of actual use. An open-headed metal drum, 9·4 cu. ft. in capacity was used; the open end had a hinged cover that opened readily at a pressure of 5 lb. per sq. in., and the other end was equipped with a shuttered opening for the introduction of the aerosol. A burning plumber's candle was put half way along the drum, and aerosols with mass median diameters of approximately 15 and 5 μ were introduced at known rates until explosions occurred. There was some leakage from the drum, and the volume of air required to atomise the amount of liquid required for explosion was added to the volume of the drum to give the space in which explosion occurred.

There was no difference between the fine and medium aerosols in the amount of volatile solvent required for explosion, xylene, acetone and cyclohexanone exploding at amounts equivalent to 39, 47·5 and 54·5 U.S. gals. per 100,000 cu. ft. and carbon tetrachloride, methylene chloride and tetrachloroethylene (perchloroethylene) not exploding at all at concentrations sufficient to extinguish the flame, but Sovacide 544C, kerosene and Deobase exploded at 40·5, 49·5 and 49·5 U.S. gals. per 100,000 cu. ft. at the smaller particle size and at 62, 80 and 81 U.S. gals. at the larger one, and Texaco 300 and Diol 50 at 36 and 48 U.S. gals. at the smaller one and not at all at the larger. The addition of the non-explosive tetrachloroethylene to Deobase, Velsicol AR-60 and Sovacide 544C did not reduce their inflammability at proportions of less than 1 : 1; the results were not conclusive, but it would probably be necessary to add at least 50 per cent. of a non-explosive solvent to raise the explosion concentration of a mixture.

It is evident that aerosols containing solvents or oils of the types tested do not present an explosion hazard if properly dispersed in a building at the usual rate of 1 U.S. gal. formulation per 50,000 cu. ft. of free air space; explosions that have occurred can be explained only by considerable overdosage, probably as a result of the discharge of the entire contents of a large machine into a confined area in which an open flame or spark was present.

Spencer (H.) & Norman (P. A.). **Experiments on Control of the Citrus Red Mite (Purple Mite).**—*Florida Ent.* **34** no. 1 pp. 3–5, 1 ref. Gainesville, Fla., 1951.

In tests against *Paratetranychus citri* (McG.) in Florida, orange trees that had received a nutrient spray in February and a post-bloom spray of basic copper sulphate and sulphur in April and had 80 per cent. infested leaves on 27th May were sprayed with acaricides on 31st May and 3rd June 1949. All spray quantities are given per 100 U.S. gals. Examination after 20 days showed that the percentages of leaves infested were 4 for 1 per cent. oil emulsion, 3 for 1 lb. Neotran (40 per cent. di(p-chlorophenoxy) methane), 6 for 1 lb. Karathane (25 per cent. 4,6-dinitro-2-caprylphenyl-crotonate), 24 for 1 lb. 70 per cent. wettable azobenzene, and 89 for 1 lb. 25 per cent. wettable parathion, the last four each with 6 lb. wettable

sulphur. In a similar test in 1950, sprays of 3 lb. basic copper sulphate and 5 lb. wettable sulphur with acaricides were applied after flowering on 15th–17th March, and the percentages of leaves infested on 10th May and (in brackets) on 14th March, before spraying, were 71 (42) for no treatment, 19 (39) for 1 lb. Neotran, 23 (36) for 1 lb. Karathane, 9 (53) for 1 lb. 70 per cent. wettable azobenzene, 23 (43) for 0·5 lb. EPN-300 (30 per cent. ethyl p-nitrophenyl thionobenzenephosphonate), 42 (37) for 2 lb. Aramite (15 per cent. 2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite), 27 (42) for 4 lb. 25 per cent. p-chlorophenyl phenyl sulphone, 37 (52) for 1 U.S. pint 923 (50 per cent. emulsifiable dichlorophenyl benzenesulphonate) and 17 (37) for 1 lb. 50 per cent. p-chlorophenyl p-chlorobenzenesulphonate. It is concluded that azobenzene, though slow in action, was the most effective.

Chamberlin (F. S.). **Aphid Trap Records in Relation to Green Peach Aphid Infestations in shade-grown Tobacco.**—*Florida Ent.* **34** no. 1 pp. 6–8, 1 fig., 2 refs. Gainesville, Fla., 1951.

Aphid traps of the wind-vane type were operated throughout the tobacco-growing seasons of 1948 and 1949 near Quincy, Florida, to obtain information on the flight of *Myzus persicae* (Sulz.), which has become an important pest of shade-grown tobacco in that area. The traps were situated in typical localities at a height of 12 ft. and were emptied five times a week. In all, 236 Aphids of 37 species were taken in 19 weeks in 1948, and 191 of 39 species in 1949. Of these, 13 in 1948 and 5 in 1949 were *M. persicae*. These small numbers indicate a very limited flight of this species and little probability of any appreciable influx from distant areas. Field observations at Quincy in 1948–50 showed generally light, scattered populations of *M. persicae* on crucifers and other occasional food-plants [*cf. R.A.E.*, A **40** 288]. Most of the Aphids on tobacco are eliminated by insecticides. The majority of the Aphids flew or were blown into the fields during the tobacco-setting season, before the cloth walls had been erected. The open-mesh cheesecloth used for the walls and tops of the fields excludes many but not all of the Aphids, and to afford the maximum protection from the insects, the walls and tops should be erected before the tobacco-setting season. A list of the species of Aphids taken in the traps is appended.

Wolfenbarger (D. O.). **Dictyospermum Scale Control on Avocados.**—*Florida Ent.* **34** no. 2 pp. 54–58, 5 refs. Gainesville, Fla., 1951.

Chrysomphalus dictyospermi (Morg.) is widely distributed and occasionally causes serious damage to avocado in Florida. Young trees seem to be more severely attacked than old ones, and some varieties more than others. Oil emulsions have been used for control, but have not always proved effective and have sometimes damaged the trees. Parathion was therefore tested in 1948–49.

Sprays of 2 lb. 25 per cent. wettable parathion per 100 U.S. gals. and 2 per cent. oil emulsion both gave approximately 70 per cent. control after two weeks when applied in January 1948, and 1 lb. 15 per cent. wettable parathion per 100 U.S. gals., alone or with 1 per cent. oil emulsion, and 1·5 per cent. oil emulsion gave 84, 20 and 58 per cent., respectively, in three weeks in December 1948. Treatment with 1, 2 and 4 lb. 15 per cent. parathion per 100 U.S. gals. gave 65, 97 and 91 per cent. control in three weeks in January 1949, and approximately 66 per cent. control in three

weeks and 78, 94 and 71 per cent. in six in December 1949; in this last test, 1·5 per cent. oil emulsion was as effective as parathion after three weeks but useless after six. It is concluded that 2 lb. 15 per cent. wettable parathion per 100 U.S. gals. water was the most effective spray tested.

Fisher (F. E.). **An *Entomophthora* attacking Citrus Red Mite.**—*Florida Ent.* **34** no. 3 pp. 83–88, 1 fig., 15 refs. Gainesville, Fla., 1951.

A fungus observed attacking *Paratetranychus citri* (McG.) in Florida in 1948–50 was identified as *Entomophthora* sp. It is similar to but not identical with *E. fumosa*. Mites infected with it showed several symptoms, which are described. Infection was most prevalent in the adults, but deutonymphs were also attacked; no visible infection was found in protonymphs. The fungus was observed throughout peninsular Florida, being present in all the heavily infested *Citrus* groves examined, and probably occurs throughout the *Citrus* belt. Counts made in heavily infested groves in September and October showed that it caused 32–95 per cent. mortality of the adult mites.

Calza (R.) & Sauer (H. F. G.). **A aranha vermelha dos cafezais.** [The Red Spider of Coffee Plantations.]—*Biológico* **18** no. 12 pp. 201–208. 2 figs., 2 refs. São Paulo, 1952.

Investigations in 1952 showed that the species of *Paratetranychus* that is injurious to coffee in São Paulo is not *P. ununguis* (Jac.) [*cf. R.A.E.*, A **41** 422], but *P. ilicis* (McG.). All stages are briefly described. The mite proved to be widely distributed in the State and was also found in Paraná. It infested only the upper surfaces of the leaves, covering them with fine webbing and causing bronzing of the area round the veins. The mites descend from leaf to leaf and are carried by the wind on long threads. Both old and young plants were attacked, but those in high, dry areas were more susceptible than those in low, damp ones. Although the mites were present throughout the year, the population increased only during the winter. It was greatest in early spring, before the rains, and was favoured by drought. Infestation was also observed on wild plants and shrubs.

In laboratory studies in October–December, the females deposited 10–15 eggs each (except for one that laid 24) on the upper surfaces of the leaves. The eggs hatched in 6–10 days, requiring about a week at an average temperature of 22·5°C. [72·5°F.], and the adults emerged after a further 5–10 days, this period also averaging about a week at 23·4°C. [74·12°F.]. The preoviposition period lasted three days, and the adult females survived for about 15 days. Unfertilised females gave rise to males. Of adults reared from eggs collected in the field, 80 per cent. were females.

Although *P. ilicis* was attacked by predacious mites, Coccinellids and Staphylinids, these were insufficient to control the infestation and did not become numerous until the end of the season. The mite appears to have been favoured by the use of insecticides on coffee, but outbreaks have also been observed in untreated plantations. The addition of 0·4 per cent. parathion or 40 per cent. sulphur to the dusts of 1·5–2 per cent. γ BHC applied against the coffee leaf-miner [*Leucoptera coffeella* (Guér.)] should give control, but early treatment is required to prevent an increase in numbers.

Sauer (H. F. G.). **Efeito dos inseticidas orgânicos sôbre as larvas do bicho mineiro do café no interior das galerias.** [The Effect of organic Insecticides on Larvae of *Leucoptera coffeella* in their Mines.]—*Biológico* **19** no. 3 pp. 57–59, 1 graph. São Paulo, 1953.

The usual method adopted for the control of *Leucoptera coffeella* (Guér.) on coffee in São Paulo is to dust against the adults, but since sprays might kill the larvae in their mines as well as the adults, various organic insecticides were tested for this purpose in 1952. Parathion proved very effective and dieldrin promising, and further tests showed that even better results were given by a mixture of the two, parathion giving good initial mortality and dieldrin maintaining control for more than 40 days.

de Figueiredo jr. (E. R.). **Sôbre uma praga do abacateiro,** *Euglyphis fibra* **(Schaus, 1890).** [On a Pest of Avocado, *E. fibra.*]—*Biológico* **19** no. 4 pp. 74–77, 2 figs., 4 refs. São Paulo, 1953.

Euglyphis fibra (Schaus), a Lasiocampid not previously recorded as injurious in Brazil, was observed causing severe damage to avocado in nurseries in Santos, usually from September to December or January, the larvae feeding gregariously on the leaves and completely destroying all but a few of the older ones, which they webbed together to form shelters for their cocoons. Brief descriptions are given of the egg, larva and adult. The females oviposited on the underside of the leaves, one individual laying 316 eggs in the laboratory, and the egg, larval and pupal stages lasted about 8, 57 and 10 days, respectively. Females were about twice as numerous as males. Sprays of 0·4 per cent. lead arsenate or 0·01 per cent. parathion gave good control of the larvae.

Riemschneider (R.). **Zur Weiterentwicklung der Insektizide der Chlorkohlenwasserstoffklasse. Kontakt-Insektizide auf Halogenkohlenwasserstoffbasis III.** [Contribution to the further Development of the Chlorinated-hydrocarbon Group of Insecticides. Contact Insecticides based on Halogenated Hydrocarbons III.]—*Euclides* **11** pp. 373–381; **12** pp. 35–41, 91–105, refs. Madrid, 1951–52. (With Summaries in Spanish and English.)

In this third part of a series [*cf. R.A.E.*, A **40** 9], the author reviews the chlorinated hydrocarbons that were used as insecticides, in all cases as fumigants, before the discovery of the contact action of DDT, gives a list of the principal chlorinated insecticides of the diene and terpene groups showing their structural formulae, and discusses from the literature and his own observations the chemical constitution and preparation of chlordane, heptachlor, aldrin, dieldrin, toxaphene and a few related compounds. The first four are dienes, and toxaphene is a member of the terpene group.

Technical chlordane (known in Germany as technical M410) has been shown to comprise a mixture of compounds, including two isomers of chlordane [*cf.* **40** 340]. The author and co-workers have prepared four isomers of chlordane, with melting-points of 101–103, 102–104, 137–139 and below 73°C., respectively. These showed widely differing toxicity to insects and are not all stereoisomers. The position of one of the chlorine atoms in heptachlor is in doubt, and the detailed composition of toxaphene, which is probably a mixture and is referred to as octachloroendomethylenetrimethylcyclohexane (M414) [*cf.* **40** 10, 49, 372], is still unknown. Two other chlorinated terpenes that have been stated to possess insecticidal properties are cis-1,8-dichloro-p-menthane and 2,6,7-trichlorocamphane. The author

has prepared tetra- and pentachloro-1-methyl-4-isopropylcyclohexanes of undefined constitution but consisting chiefly of the tetra- and pentachloro derivatives of p-menthane, and found that their toxicity to insects depended much on the conditions of synthesis.

Feinstein (L.) & Jacobson (M.). **Insecticides occurring in Higher Plants.** —*Fortschr. Chem. org. Naturst.* **10** pp. 423–476, 272 refs. Vienna, 1953.

In this review of knowledge on insecticides obtained from plants, the authors give details of the chemical structure, insecticidal effectiveness and toxicology of nicotine and the other tobacco alkaloids, nornicotine and anabasine; of rotenone and the related compounds, deguelin, tephrosin, toxicarol, sumatrol, malaccol and elliptone; and of the pyrethins and cinerins. They give shorter accounts of synthetic products similar to the pyrethrins and cinerins, including allethrin; of the unsaturated isobutylamides, pellitorine, from the roots of *Anacyclus pyrethrum* [*R.A.E.*, A **40** 7], spilanthol, from the flowers of *Spilanthes oleracea* and *S. acmella*, affinin, from the roots of *Heliopsis longipes* [**36** 25], herculin, from the bark of *Zanthoxylum clava-herculis* [**40** 7], sanshool-I and sanshool-II, from the fruits of *Z. piperitum*, and scabrin, from the roots of *H. scabra* [**40** 7]; of the synergistic effect with pyrethrins of sesamin and related compounds, including its optical isomers, asarinin and iso-sesamin, and piperine; of essential oils, including camphor and turpentine, and fatty oils, which are used as attractants or repellents; and of the insecticidal principles obtained from *Ryania speciosa* [**39** 209], *Tripterygium wilfordii* [**42** 65, etc.], *Quassia amara*, *Schoenocaulon officinale* (sabadilla), *Veratrum album* [**38** 51], *Mammea americana* [**40** 395] and *Delphinium* spp. [B **36** 218].

Martin (H.). **Contribution à l'étude du capnode noir des arbres fruitiers (*Capnodis tenebrionis* L.) dans la région d'Alger.**—*Rev. Path. vég.* **30** fasc. 2 pp. 97–113, 10 figs., 8 refs. Paris, 1951.

Observations in 1949–50 on the habits of *Capnodis tenebrionis* (L.) in Algeria showed that stone-fruit trees of all the varieties examined were infested, particularly when in a weakened condition. Quince and, in the insectary, loquat and apple, were also attacked, but the last two are unlikely to be damaged in the field. The adults were active from March to November, particularly from May onwards, and were most numerous in July. Some of the females that emerged early in the summer deposited eggs the same year, from 9th August to 21st September, after preoviposition periods of 25–45 days, whereas the others, and all those that emerged late, did not [*cf. R.A.E.*, A **41** 191]. They overwintered in the orchards and oviposited in the following year from late May or early June to mid-August, mainly in the first half of July. Females in their first and second years laid up to 100 eggs per day, with averages of 47 and 14, respectively, and totals of up to 643 per season, with averages of 169 and 119, respectively. The egg stage lasted 8–45 days, averaging 20, 15, 16 and 26 days, in June, July, August and September, respectively. Embryonic development was not affected by low relative humidities, but was inhibited by high ones, which favoured the growth of moulds. There appeared to be four larval instars [*cf.* **33** 384], usually lasting 6–15, 9–24 and 11–32 days and ten months or more, respectively, on myrobolan and peach. Larvae from eggs laid by newly emerged females overwintered in the third or occasionally the second instar, and those from the eggs of overwintered females

in the fourth instar, in cells beneath the bark of the root or collar of the tree.

Jannone (G.). **Studi e ricerche di entomologia agraria in Eritrea e in Etiopia. VIII. Stato fitopatologico delle colture in un'azienda agraria del territorio di Fadis (Harar, Etiopia) con particolare riguardo a un'infestazione afidica del " Suff "** (*Carthamus tinctorius*). [Studies and Researches on agricultural Entomology in Eritrea and Ethiopia. VIII. The phytopathological Condition of Crops on a Farm in the Fadis Territory (Harar, Ethiopia) with particular Reference to an Infestation of Aphids on Safflower.]—*Riv. Agric. subtrop.* **46** no. 4–6 pp. 132–137, 2 refs. Florence, 1952. (With a Summary in English.)

In this part of a series [*cf. R.A.E.*, A **41** 241], the author gives notes on insects found in September–October 1940 infesting crops on a farm in the Fadis district of Ethiopia. Safflower (*Carthamus tinctorius*), whether grown alone or interplanted with castor (*Ricinus communis*), was severely infested by a species of *Macrosiphum* considered to be *M. solidaginis* (F.) [*cf. loc. cit.*]. The Aphid formed colonies on the lower surface of the leaves and on the stems and bracts and, together with a fungus that attacked the leaves, caused the plants to dry up and prevented the crop from maturing. No natural enemies were observed. It was noticed in the mixed plantings that many Aphids had migrated to the castor plants, and the ground beneath these was covered with dead or dying individuals, apparently affected by some toxic substances, probably ricin and ricinine [*cf.* **32** 131], ingested with the sap. However, an infusion prepared by soaking the young plants in boiling water for an hour had no effect when applied as a spray to safflower or when the Aphids were dipped in it. Sprays of 1 per cent. tobacco extract or 0·1 per cent. nicotine sulphate gave effective control, but were uneconomic for treating large areas.

The other insects recorded are *Acrosternum* (*Nezara*) *pallidoconspersum* (Stål), *Nezara viridula* (L.) and *N. viridula* var. *torquata* (F.) on castor, an Aphid (probably *Aphis fabae* Scop.) on beans, and unspecified termites injuring groundnuts, but all were of negligible importance.

Chiaromonte (A.). **La *Platyedra gossypiella* Saund. a Tessenei.** [*P. gossypiella* in Tessenei.]—*Riv. Agric. subtrop.* **47** no. 4–6 pp. 119–121, 2 refs. Florence, 1953. (With a Summary in English.)

Cotton in the Tessenei district of Eritrea was found to be free from *Platyedra gossypiella* (Saund.) in 1926 [*R.A.E.*, A **18** 452] and remained so until 1940, when cotton-growing was suspended. Cultivation was resumed in 1951, with seed from the Sudan, and larvae of *P. gossypiella* were found in green bolls in 1953, together with larvae of *Earias* [**19** 471] and *Diparopsis*.

Barbosa (A. J. S.). **Estudo comparativo da biologia dos " manchadores da fibra " em Moçambique e das medidas para o seu control.** [A comparative Study of the Bionomics of Cotton Stainers in Mozambique and Measures for their Control.]—*Portug. Acta biol.* (A) **3** no. 1 pp. 1–24, 5 col. pls., 14 figs., 8 refs. Lisbon, 1950. (With a Summary in English.)

Investigations in Mozambique showed that the species of *Dysdercus* injurious to cotton there are *D. nigrofasciatus* Stål, which is most abundant in the south, *D. fasciatus* Sign., which predominates in the north, and *D. intermedius* Dist. *D. superstitiosus* (F.), which was recorded from the

colony in 1930 [*R.A.E.*, A **19** 133], was not found. The eggs and nymphs of the three species are described, and characters are given differentiating the adults.

From December 1948 to April 1949, all three species were reared in the laboratory at 25°C. [77°F.] and a relative humidity of almost 100 per cent. The females oviposited 1–8 times, after a preoviposition period of 5–9 days, and usually laid over 100 eggs at each oviposition. The maximum observed was 829 for a female of *D. nigrofasciatus* that oviposited eight times. Unfertilised females laid no eggs. The egg stage and the five nymphal instars lasted 4–9, 3–4, 3–11, 4–14, 6–11 and 9–17 days, respectively, and observations on *D. nigrofasciatus* showed that males and females that had paired survived for averages of 48·8 and 33·7 days, respectively.

The principal natural enemies present are Reduviids of the genus *Phonoctonus*, but they do not provide adequate control. The plants from which *Dysdercus* migrates to cotton included *Hibiscus*, *Abutilon* and *Sterculia* spp., *Adansonia digitata* and *Ceiba pentandra*, and the destruction of these near cotton fields is advised. The main invasion of cotton occurs in May, and as the crop is not picked until mid-August, severe damage results. The development of early-maturing varieties to be sown in November with the first rains and harvested in June or early July is recommended, and a close season of five months should be strictly maintained.

DE WET (W. J.) & WEBB (D. van V.). **Field Observations on the Behaviour of Hoppers of the Brown Locust in the swarming Phase.**—*Sci. Bull. Dep. Agric. S. Afr.* no. 337, [2+] 38 pp., 15 figs., 16 refs. Pretoria [?1952].

The observations described concerned the diurnal behaviour of gregarious hoppers of *Locustana pardalina* (Wlk.) and were carried out mainly on the southern edge of the Kalahari desert in 1937, with some supplementary investigations in other parts of Cape Province in later years. They indicated that the hoppers spend the night on shrubs and bushes and show little activity before sunrise; this period provides ideal conditions for the application of sprays and dusts. Most of them leave the plants when the air temperatures rise to 59–69°F., and bask in the sun on the ground until air temperatures reach 76–86°F., when migration and feeding begin; air and soil temperatures of 79 and 102°F., respectively, appeared most favourable for migration. At midday, at air temperatures of 85–90°F. and soil temperatures of 125–145°F., feeding becomes less intense and migration intermittent, as hoppers climb on to the plants for short periods to avoid the hot soil. Normal feeding and migration are resumed during the afternoon when ground temperatures have fallen to 102–111 and air temperatures to 91–96°F. and continue until air temperatures of 78–83°F. are reached in the evening, when the hoppers bask on the ground before ascending the plants for the night. Feeding continues from the morning descent until just before sunset, and baiting can be successfully carried on throughout this period; bait applied before the hoppers leave the plants in the morning may dry out before feeding begins. The air temperatures that limit feeding were not determined, but environmental temperatures appeared seldom likely to become too high in the areas normally infested by *L. pardalina*. Hoppers do not feed for about ten hours before a moult, and bait should not be distributed until all the hoppers in a band have finished moulting.

From observations on five bands of hoppers migrating from a common hatching ground, the authors conclude that migration is not induced by

lack of food, though its speed and the distance covered are influenced by the amount of food available and both are reduced when food is plentiful. The rate is also reduced when the bands are dense and during the cooler parts of the day; the average rates of movement during the morning, afternoon and midday period were 239, 314 and 117 yards per hour, respectively. All five bands ultimately reached destinations to the north-east of the starting point, and there was some evidence that they travelled down wind. The total distance traversed before the final moult averaged almost 17 miles, of which more than half was covered during the fourth and fifth instars. No migration took place during moulting. Several species of larks were observed halting the migrating hoppers and herding them into compact masses on which they fed; as few as 6–10 birds were able to halt a band.

An account of observations on the effect of rain on hatching is included, with a description of the hatching process. Only 30 per cent. of the eggs had hatched by 26th November in a bed that received no rain from April, when they were laid, until 30th October, when about 0·25 in. fell; a further 60 per cent. were destroyed by natural enemies and desiccation, and 10 per cent. were healthy and contained half-grown embryos. The rainfall was insufficient to induce plant growth, and most of the hoppers probably starved. In another egg-bed, deposited at the same time, that received 0·5 in. rain on 23rd October and a further 0·15 in. eight days later, almost all the eggs hatched, though those in pods that were washed out of the soil became shrivelled. A week after the rain, large numbers of *Wohlfahrtia* (*Afrowohlfahrtia*) *pachytyli* (Tns.) (*W. euvittata* Villen.) [*R.A.E.*, A **28** 140] were observed depositing larvae in the egg pods.

Blackith (R. E.). **Fumigation of agricultural Products. V. The Distribution of Nicotine Vapour in Glasshouses.**—*J. Sci. Fd Agric.* **4** no. 11 pp. 512–517, 3 graphs, 9 refs. London, 1953.

El Nahal (A. K. M.). **VI. Penetration and Sorption of Hydrogen Cyanide in Wheat fumigated at reduced Pressures.**—*T. c.* pp. 517–522, 1 graph, 13 refs.

In the first of these two parts of a series that has hitherto been concerned with the control of nematodes, the author describes a modification, suitable for use in glasshouses, of a micro-method of determining nicotine in air, depending on the colorimetric estimation of the yellow complex that it forms with bromothymol blue in slightly acid solutions, records tests in which the vapour pressure of 95 per cent. technical nicotine was found to be only 0·02 mm. at 25°C. [77°F.], as compared with 0·0425 mm. for pure nicotine, and gives the results of observations on the distribution of nicotine vapour in a glasshouse. One end-section of the glasshouse was fumigated, and no attempt was made to render it gas-tight. Technical nicotine was used at rates of 0·0625–2 oz. per 1,000 cu. ft., evaporated over a lamp in 70–90 minutes, and samples were taken from a height of two feet above the evaporator and at various other positions in the house. Concentration-time curves plotted from these were practically independent of dosage at 0·25 oz. or more per 1,000 cu. ft., indicating that neither increase of dose nor passage of time materially improves distribution, the continuous introduction of fumigant being offset by the continuous loss through leakage, and the concentration over the evaporator quickly rising to the saturation value, remaining constant until evaporation is complete and then rapidly falling to zero. At less than 0·25 oz. per 1,000 cu. ft., the concentration-time products for all positions tended to diminish with dosage. Increasing both

dosage and rate of vaporisation produced no greater concentration-time product unless the rate was so high (3 oz. per hour) that nicotine fog was formed, and there is little evidence that particulate nicotine is as effective, biologically, as the gas. A strong cross-wind materially reduced the efficiency of fumigation, stirring with a punkah enhanced the leakage of fumigant, and fumigating while the temperature was rising resulted in undesirable layering.

It is concluded that normal glasshouses are so little gas-tight that effective fumigation ends when the nicotine has been evaporated. The optimum dosage is about 0·25 oz. per 1,000 cu. ft., and the rate of evaporation should be about 0·25 oz. per hour with the usual spirit-lamp evaporators.

The second part comprises a study of the penetration by hydrogen cyanide into single sacks of wheat of three moisture contents fumigated at rates of 10–26 mg. per litre at atmospheric pressure, in a sustained vacuum or by vacuum fumigation with simultaneous admission of air and fumigant. The results as regards effectiveness against *Calandra granaria* (L.) and *C. oryzae* (L.) have already been noticed [*R.A.E.*, A **42** 39]. Gas samples were taken from various points 10–240 minutes after the fumigant had been introduced; after the last sample had been taken, and before the chamber was opened, the grain that had been fumigated by the two vacuum methods was washed twice with clean air and air samples were extracted after each wash. Wheat was taken from the surface and from the centres of the sacks immediately after the last air-wash or after the grain fumigated at atmospheric pressure had been aired for ten minutes.

At all dosages for an exposure period of four hours, penetration, as indicated by concentration-time products, was apparently equal for fumigation at atmospheric pressure and with simultaneous introduction of fumigant and air and much greater for fumigation under sustained vacuum, the very low penetration factors (1·8, 2·5 and 19·5, respectively) [*cf.* **41** 350] reflecting the high sorption of HCN. For sustained-vacuum fumigation, the concentration-time products in the free space and at the centre of the sack were about equal. Analysis after fumigation showed that HCN residues were practically equal at the top and centre of the sack after sustained-vacuum fumigation and much less at the centre for the other two methods, owing to poor penetration. Sorption increased rapidly with moisture content, residues being doubled and concentration-time products increased by 10 per cent. as it rose from 9 to 17 per cent., but the wheat at the centre of the sack was partly protected by this higher sorptive capacity in the outer wheat, resulting in poorer penetration at higher moisture contents.

Concentrations in the free space were reduced by 75 per cent. after the first air-wash and by 85 per cent. after the second, but concentrations at the centre of the sack after sustained-vacuum treatments were in many cases higher after the second air-wash than immediately before normal pressure was restored. For most practical purposes, the residual fumigant is proportional to the concentration-time product attained round the sample of wheat analysed, except as it is affected by the increase in sorption on wheat of higher moisture contents and at low pressures.

Clegg (K. M.) & Lewis (S. E.). **The Vitamin-B Content of Foodstuffs fumigated with Methyl Bromide.**—*J. Sci. Fd Agric.* **4** no. 11 pp. 548–552, 12 refs. London, 1953.

The following is substantially the authors' summary. The effect of methyl bromide on some of the B-vitamins, both in aqueous solution and

in foodstuffs, was studied. From analysis of the bromide residues, it appeared that some reaction had occurred in solutions of nicotinic acid and nicotinamide that had been treated with high concentrations of methyl bromide. Likewise, a slight loss of nicotinamide was found on chemical analysis of the solution, and was confirmed by the appearance of a substance resembling N′-methylnicotinamide. In milled wheat, the nicotinic acid, thiamine and riboflavin values were not diminished after treatment with various concentrations of methyl bromide, or by fumigation at different moisture contents. Similarly, no loss was found in a range of foodstuffs, including groundnuts, whole wheat, barley, peas, beans, maize and rice, treated at concentration-time products far higher than those normally used in practical fumigation.

HÅRDH (J. E.). **Kevätvehnän kahutähkäisyydestä sekä sen syistä Suomessa.** [On the Shrivelheads of Spring Wheat and their Causes in Finland.]—*Valt. Maatalousk. Julk.* no. 140, 152 pp., 35 figs., 8 graphs, 8½ pp. refs. Helsinki, 1953. (With a Summary in English.)

The following is based on the author's summary. The yield of spring wheat in Finland is reduced, particularly in western districts, by an affection known as shrivelheads. It is characterised by shrinking and premature ripening of the kernels and inferior baking quality of the flour, and results from interruption of the development of the grains caused by foot-rot fungi and less frequently by larvae of *Amblymerus graminum* Hårdh, which develop in the stems [*cf. R.A.E.*, A **40** 94], and an account is given of investigations in 1949–53 on these agents.

A. graminum was found to infest several graminaceous plants, particularly *Agropyrum repens*. Its distribution on wheat in Finland is shown on a map, and all stages are described. The overwintered larvae pupated from mid-May onwards, though some did so in January in the laboratory, and the adults emerged 13–23 days later. Oviposition began 5–7 days after emergence, and continued until mid-July, dissected females containing an average of 55 eggs each. The eggs were deposited through the wall of the plant stem, preferably near egg-batches of *Miris* spp. The larvae hatched in about 2–5 days and fed on the Mirid eggs if available or on eggs and young larvae of their own species, but in the absence of these they developed normally on the sap from the stem wall. The full-fed larvae generally overwintered in the stubble or straw, but some gave rise to adults at the end of August and these produced a further generation, of which the larvae also became full-fed by autumn and overwintered.

In laboratory studies, the ability of the larvae to survive flooding in spring was tested by keeping examples submerged for 5–25 days in tap-water at 0–4°C. [32–39·2°F.]. All remained vigorous, and their colour and turgor were normal. Exposure for a week to severe frost, however, was fatal. Snow affords some protection in nature, but parts of the infested area sometimes have little or no snow in winter. The larvae were negatively phototactic and died when exposed to ultra-violet light, direct sunlight or daylight. Saturated air was essential for normal development, and young larvae dried up in 8–10 minutes at 70 per cent. relative humidity. Of 181 samples of larvae examined, a mean of 89·6 per cent. contained animal food. Natural enemies of the larvae included fungi, Tarsonemid mites, and larvae of *Panstenon assimilis* (Nees), which also consumed the eggs and those of *Miris* spp. No method of control is known, but crop rotation is probably beneficial.

Brammanis (L.). **Bidrag till kännedomen om för skogen skadliga bladhorningar i Sverige. I. Trädgårdsborren,** *Phyllopertha horticola* **L.** [Contributions to Knowledge of Lamellicorns injurious in Forests in Sweden. I. The Garden Chafer, *Anomala horticola*.]—*Medd. SkogsforsknInst.* **41** no. 2, 59 pp., 26 figs., 4 pp. refs. Stockholm, 1953. (With a Summary in German.)

The Lamellicorns that are important as soil pests in forest nurseries in Sweden are *Melolontha melolontha* (L.), *M. hippocastani* F., *Amphimallon solstitiale* (L.), *A. s. fallenii* (Gylh.), *Anomala* (*Phyllopertha*) *horticola* (L.), *A. dubia* var. *aenea* (Deg.) and *Serica brunnea* (L.). In this first part of a series to be devoted to them, the author describes all stages of *A. horticola*, reviews the literature on that Rutelid in Sweden and other countries, and gives an account of investigations on its bionomics and control carried out in 1948–51 in the insectary and field. The following is based on his summary of the results.

A. horticola is common in southern and central Sweden, and its life-cycle lasts one year. The adults emerge at the beginning of June in the south and 1–2 weeks later in central districts and are present for about a fortnight. The fertilised females oviposit in the soil, chiefly in sunny, sheltered pasture or fallow land, and plants in forest nurseries in or near such areas are liable to serious injury, the larvae feeding on the roots and killing seedlings. The egg and pupal stages each last about three weeks, and the larvae overwinter in the soil, pupating in May.

In experiments, good control was obtained by dusting the trees in a nursery with 5 per cent. BHC or a mixture of 5 per cent. DDT and 10 per cent. BHC against the adults, and the mixture was also effective against adults entering or leaving when applied to the soil, though a high rate of application was necessary. A dust of 5 per cent. BHC was very toxic to the larvae when incorporated into the upper layer of soil at 0·6 oz. per sq. yd. in September, giving complete mortality in four months, and a 3·5 per cent. dust and an emulsified solution of BHC gave similar results at equivalent rates of application; tender plant roots should be protected from this insecticide.

Lekander (B.). **En ny metod för bekämpning av granbarkborren,** *Ips typographus* **L.** [A new Method for the Control of *Ips typographus*.] —*Medd. SkogsforsknInst.* **41** no. 3, 31 pp., 11 figs., 4 refs. Stockholm, 1953. (With a Summary in German.)

Details are given of experiments in Sweden in 1949–50 already noticed, in which it was found that zinc fluosilicate and sodium arsenite could be applied to spruce trees so that they are carried up by the sap stream and kill various stages of *Ips typographus* (L.) [*cf. R.A.E.*, A **41** 34]. The ring of bark removed for the application of the zinc-fluosilicate paste was about 4 ins. wide, but further tests in 1951 showed that removal of a band less than an inch wide was sufficient on trees with a diameter at breast height of up to about 8 ins.

In tests of the suitability of the treatment with zinc-fluosilicate paste for trap-trees and trap-logs, uninfested spruces were treated in the autumn of 1950 and left standing, and further trees were treated in early May 1951 and either left standing or felled at intervals between four hours and ten days later. The width of the bark removed was 4 ins. Observations in October 1951 showed that the trees treated in the preceding autumn had not been attacked, though surrounding untreated trees were infested, and autumn treatment thus appears useless, the trees losing their attractiveness for the beetles. Of those treated in the spring, all were attacked and

those left standing for at least three days after treatment proved completely toxic to the beetles that entered them and to such larvae as were produced. Other bark-beetles were similarly affected. Both the standing and the felled treated trees were as attractive to the beetles as the respective untreated ones, but the standing trees were somewhat less attractive than those felled.

In a test to find a simpler method of application, downward cuts in the bark were made round the tree with an axe and the bark bent outwards, and the paste was diluted to a thinner consistency and applied in the channel so formed. The results were satisfactory in some cases, but not in all.

Sylvén (E.). **Syrastekeln och dess bekämpning.** [*Ametastegia glabrata* and its Control.]—*Växtskyddsnotiser* 1952 no. 3 pp. 35–39, 2 figs. Stockholm, 1952.

Ametastegia glabrata (Fall.) has increased in importance as a pest of apples in southern Sweden of recent years, and the larvae were found infesting about 10 per cent. of the crop on one large farm in 1950. Notes are given on the bionomics of this sawfly, largely from investigations in the United States [*R.A.E.*, A **5** 241–242]. There are several generations a year in Sweden, and in incomplete insectary studies in 1951, adults of the overwintered and first generations emerged between late May and mid-June and between mid-July and early August, respectively. The larvae feed on the leaves of the low-growing plants on which the eggs are laid and enter the ripe or almost ripe fruits on the trees in late summer and autumn, when they are ready to overwinter. Eggs and larvae were observed on *Polygonum convolvulus* and *P. amphibium terrestre* in orchards, and, in tests, the larvae fed on *Rumex* spp., but not on beet or several leguminous plants. A spray of a proprietary preparation containing pyrethrum and BHC, applied to the trunks and the ground round the trees by the grower in the early autumn of 1950, afforded little protection. In tests in 1951 on the possibility of protecting the fruit by spraying weeds beneath the trees in mid-August, plots were treated with 0·2 per cent. by volume of an emulsion concentrate containing 5 per cent. parathion and 2 per cent. methyl-parathion by weight, a suspension of about 0·05 per cent. by weight DDT, or 0·17 per cent. by volume of a preparation containing 18 per cent. DDT, 4 per cent. γ BHC, 1 per cent. pyrethrum and piperonyl butoxide and 5 per cent. wetter, all by weight. The rate of application was about 72–84 gals. per acre. Counts of larvae on selected infested *Polygonum* plants in the plots before or immediately after spraying and again two days later showed that the numbers fell from 50 to 35 for no treatment, from 27 to 23 for water only, from 68 to 25 for DDT only, from 71 to 3 for the mixed spray and from 73 to 3 for the parathion spray, and the last two are therefore recommended.

Sylvén (E.). **Ytterligare erfarenheter om skidgallmyggans bekämpning.** [Further Experience in the Control of *Dasyneura brassicae*.]—*Växtskyddsnotiser* 1952 no. 3 pp. 41–46, 2 figs. Stockholm, 1952.

Following an experiment in Sweden in which it was found that dusting with 2 per cent. methyl-parathion protected spring rape from infestation by *Dasyneura brassicae* (Winn.), largely by controlling *Ceuthorrhynchus assimilis* (Payk.) [*R.A.E.*, A **40** 193], similar tests were carried out in 1951 on winter rape. Plots were arranged in two localities according to principles indicated. In the first of these, the rape was dusted with 5 per cent. DDT or 2 per cent. of a thiophosphate compound [? methyl-parathion] on 24th and 30th May, during the periods of full and late bloom, and in

the second, the same dusts were applied on 26th May, at full bloom, only. The rates were 14·4–16·2 lb. per acre. Subsequent sweeping with a net indicated that all the full-bloom treatments almost eliminated *Meligethes aeneus* (F.), and all but those with DDT reduced *C. assimilis*. Adults of *D. brassicae* were not taken in sufficient numbers for the counts to be reliable, but examination in late June indicated that the percentages of pods attacked by it were reduced to 53 and 80 in the two localities, respectively, by DDT and to 16 and 49 by the other dust, infestation in the controls being taken as 100 per cent.

Ossiannilsson (F.). **Bladlöss i växthus än en gång.** [Aphids in Glasshouses again.]—*Växtskyddsnotiser* 1952 no. 4 pp. 53–57. Stockholm, 1952.

In this discussion of the ways in which *Myzus persicae* (Sulz.) may survive the winter in Sweden, it is stated that overwintering in the egg stage on peach occurs in the south but can be of only slight importance as regards subsequent spread [*cf. R.A.E.*, A **31** 438]. Overwintering of parthenogenetic forms on crucifers in the field appears normally to be rare, and when living examples were transferred in the autumns of 1943 and subsequent years to cabbage and brussels sprouts in the open, none could be found in the following springs. No Aphids were observed in the springs of 1948 or 1952 on overwintered rape or other crucifers or on autumn-sown spinach, though the winters concerned did not particularly favour survival. Some overwintering probably occurs on root crops stored in cellars, but observations in 1948 indicated that beet clamps are not a source of spring infestation. Glasshouses are of more importance, and an inspection in one area in April 1952 showed that five of 16 were infested. The Aphid was numerous in three, and very common on carnations in one glasshouse in which the regular spraying programme had been interrupted.

Fjelddalen (J.). **Midder på frukttraer og baervekster. Biologi og bekjemping.** [Mites on Fruit Trees and Berries. Bionomics and Control.]—*Frukt og Baer* **5** pp. 56–72, 8 figs., 35 refs. Oslo, 1952. (Reprint (19 pp.) has a Summary in English, pp. 16–18.)

Tetranychid mites have long been injurious to fruit trees and small fruits in Norway but have been increasingly harmful since 1930 and particularly since the introduction of DDT. The species concerned are *Paratetranychus pilosus* (C. & F.) on apple and plum, *Bryobia praetiosa* Koch, which has been known for many years on gooseberries and was common on pear and to a less extent apple in 1950–51, and *Tetranychus* sp., probably *T. telarius* (L.) (*althaeae* (v. Hanst.)), which has attacked currants, raspberries and strawberries, particularly the last two, since 1948. In addition, strawberry is infested by *Tarsonemus pallidus* Banks. General notes are given on the bionomics of the last three. Observations on *P. pilosus* on apple in 1948–51 showed that 15–20 per cent. of the winter eggs hatch by the time the trees reach the pink-bud stage, and most of the rest during the fortnight of flowering and petal-fall. There are 3–4 generations during the year, depending on weather, and the degree of infestation depends on the temperature in spring and early summer. The principal natural enemies of the mite in Norway are *Anthocoris nemorum* (L.), Coccinellids, and the larvae of *Conwentzia psociformis* (Curt.).

In experiments against the winter eggs of *P. pilosus* on apple, the best results were given by sprays of oil or DNC in oil applied at reduced strength

between the stages of breaking and bud-burst, DNC in oil proving superior in districts with damp weather at the time of application. These treatments did not damage any of the varieties of apple tested. Even though winter sprays are applied, summer sprays are necessary to prevent the population of *P. pilosus* from increasing dangerously. Parathion is commonly used for this purpose, but it has little persistent effect, kills predators and is very toxic to man. In tests in 1950–51 with systemic toxicants, 0·1 per cent. Pestox 3 (containing 66·6 per cent. schradan) and 0·05 per cent. Systox (50 per cent. diethyl 2-(ethylmercapto)ethyl thiophosphate) gave complete control for a fortnight when applied before flowering and again 12 days later. Similar treatments with 0·4–0·5 per cent. Ovotran (20 per cent. p-chlorophenyl p-chlorobenzenesulphonate), 0·125 per cent. Dimite (25 per cent. 1,1-bis(p-chlorophenyl)ethanol) and 0·2 per cent. Aramite (15 per cent. 2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite) proved equally effective. Ovotran afforded the best residual protection, and prevented an increase in numbers for 5–6 weeks.

In tests against *Tetranychus* sp. on strawberries in the same years, single applications of 0·1–0·15 per cent. Systox, 0·15 per cent. Pestox 3, 0·5 per cent. Ovotran, 0·2 per cent. Aramite, 0·125 per cent. Dimite and 0·12 per cent. of a 10 per cent. parathion emulsion concentrate in early June all gave excellent control for three weeks and all but parathion for nine, and were the most effective sprays tested. The yield was decreased somewhat by Aramite, owing apparently to some internal damage, and increased by all the other materials, Systox giving the greatest increase. Sprays of 0·01–0·03 per cent. of a preparation containing 70 per cent. parathion checked *Tarsonemus pallidus* in fields of strawberries 1–2 years old.

Fjelddalen (J.). **Systemiske midler mot skadedyr på frukttraer, baervekster og prydplanter.** [Systemic Insecticides against Pests of Fruit Trees, Berry Fruits and ornamental Plants.]—*Meld. Plantev.* no. 8, 40 pp., 7 figs., 21 refs. Oslo, 1953. (With a Summary in English.)

The author reviews the chemistry and mode of action of the systemic insecticides schradan, bis(monoisopropylamino) fluorophosphine oxide and diethyl 2-(ethylmercapto)ethyl thiophosphate and gives an account of tests with them in Norway in 1950–52, some of which have already been noticed. Schradan was used as Pestox 3, Sytam and Tetrax, which contain 66, 70 and 66 per cent. toxicant, respectively, the fluorophosphine oxide as Isopestox, containing 90 per cent. toxicant, and the thiophosphate as Systox, containing 50 per cent. toxicant. Systox was used at 0·05 per cent. of the formulation, and the other preparations at 0·1 per cent.

Systox and schradan gave excellent control of *Paratetranychus pilosus* (C. & F.) on apple [*cf.* preceding abstract] and also on plum, and of *Aphis pomi* Deg. on apple (against which they were superior to parathion or nicotine sulphate). All three compounds, and particularly Systox, were effective against *Myzus cerasi* (F.) and *Anuraphis roseus* Baker (*Yezabura malifoliae*, auct.) on cherry and apple, respectively [*cf. R.A.E.*, A **40** 192], and *Hyalopterus arundinis* (F.) and *A. padi* (L.) (*A. helichrysi* (Kalt.), *Aphis pruni*, auct.) on plum. In large-scale tests on apple and plum in 1952, both schradan and Systox gave excellent control of *P. pilosus* and Aphids. Schradan was most effective when applied early in the season and appeared to be more dependent than Systox on vigorous growing conditions. Systox is not recommended for use with lime-sulphur, but lost none of its effectiveness when applied with it against *Aphis pomi* in one test. The only other insects affected were larvae of *Lyonetia clerkella* (L.) on apple and those

of *Hoplocampa minuta* (Christ) on plum, which were controlled to some extent by Systox. Both schradan and Systox controlled *Tetranychus* sp. on strawberry [*cf.* preceding abstract], but even two applications of Systox were not effective against *Phyllocoptes* (*Eriophyes*) *gracilis* (Nal.) on raspberry.

The tests on the ornamental plants were carried out in greenhouses and were mainly directed against *Tetranychus telarius* (L.) (*althaeae* (v. Hanst.)) and Aphids. *T. telarius* was controlled on carnations by drenching once with Systox or twice with schradan, and sprays of Systox or schradan were effective on roses against strains of the mite resistant to parathion [*cf.* **40** 278]. One application of either Systox or schradan in a spray gave satisfactory control of Aphids on various plants, Systox proving superior late in the season. Soil treatments with either material did not control *Pseudococcus maritimus* (Ehrh.) on *Fuchsia* or *Coccus* (*Lecanium*) *hesperidum* L. on other plants, but sprays or dips of Systox proved effective, though several applications were necessary. Both materials showed promise against leaf-mining larvae of *Phytomyza atricornis* Mg. and *Trypeta* (*Phorellia*) *artemisiae* (F.) on chrysanthemums.

Plantesygdomme i Danmark 1950 (-1951). Plant Diseases and Pests in Denmark 1950 (-1951).—*Tidsskr. Planteavl* **56** pp. 1–59, 1 fig., 2 graphs; **57** pp. 1–67, 2 graphs; also as *Årsovers. plantepat. Forsøg.* nos. 67–68. Copenhagen, 1952, 1954. (With Summaries in English.)

These two reports contain sections (pp. 30–45, 46; 32–47, 50–51) in which P. Bovien surveys the principal pests of cultivated plants in Denmark in 1950–51, as in previous years [*cf. R.A.E.*, A **40** 190]. Attacks in 1950 were not in general severe or widespread, and *Leptinotarsa decemlineata* (Say), which appeared in Denmark for the first time in 1949 [*cf.* **39** 130] was found on potato on only one farm in Jutland where severe control measures had not been applied in the previous year. No adults of the summer generation were observed. Many of the usual pests were more injurious in 1951, those recorded as especially harmful including *Contarinia medicaginis* Kieff. on lucerne, *Cneorrhinus plagiatus* (Schall.) on swedes and mangels, *Meligethes aeneus* (F.) on swedes grown for seed and also winter rape, *Psila rosae* (F.) and *Trioza* (*Psylla*) *apicalis* Först. on carrot, and *Argyresthia conjugella* Zell. on apple. A few adults of *L. decemlineata* were taken in southern Jutland in June and July, but no eggs or larvae were seen. In the insectary [*cf.* **39** 291], overwintered females oviposited on 23rd June, and the first larvae hatched about a week later. Adults of the first generation did not appear until 20th August.

Pests recorded for the first time in Denmark included *Dasyneura mali* (Kieff.) on apple and the sawfly, *Priophorus pallipes* (Lep.) (*padi*, auct.), on raspberry and cherry in 1950 and *Nasates* (*Phyllocoptes*) *fockeui* (Nal. & Trt.) on plum and *Triphaena* (*Agrotis*) *pronuba* (L.), which damaged fallen apples and pears in orchards and the picked fruit in boxes beneath the trees, in 1951.

Wagn (O.). **Om den store kålfluе (*Chortophila floralis* Fall.).** [The Large Cabbage Fly, *Hylemyia floralis*.]—*Tidsskr. Planteavl* **56** pp. 470–477, 2 figs., 2 refs.; also as *Beretn. Forsøgsv. PlKult.* no. 470. Copenhagen, 1953. (With a Summary in English.)

Both *Hylemyia* (*Chortophila*) *brassicae* (Bch.) and *H.* (*C.*) *floralis* (Fall.) are important pests of swedes and cabbage in Denmark, the latter being the more injurious to swedes. *H. brassicae* occurs throughout the country.

The adults of the overwintered generation emerge from the soil in late May or early June and oviposit soon after, and there are up to three generations a year, of which the first is the most harmful. *H. floralis* is common in certain parts of Jutland and rare in other districts. It has only one generation a year, and infestation occurs relatively late in the summer. There is considerable variation from year to year in the time of adult emergence. Special observations in 1931 showed that it began in late June and reached its maximum between 9th July and 3rd August, and similar studies at one place in 1952 that it continued from early August to late September, the majority of the flies emerging in the first half of August; in other localities, it continued until mid-October. The oviposition period varies similarly and lasts for 1–4 weeks or more. The egg and larval stages last a few days and 2–3 weeks, respectively, and the full-fed larvae pupate in the soil, the pupae overwintering.

In tests on the control of *H. floralis* on swedes in 1952, dusts of 10 per cent. chlordane at 45 or 90 lb. per acre were applied in mid-April, before sowing, 20 per cent. wettable aldrin and 2·5 per cent. lindane [almost pure γ BHC] at 22·5 lb. per acre in mid-June and mid-July, and 2·5 per cent. lindane at 45 lb. per acre in mid-June; all were hoed into the soil. Aldrin was the only material that had any considerable effect on infestation; the reduction reached an average of 32·9 per cent. when the dust was applied along the rows in June and was considerably less when it was evenly distributed over the whole of the area.

Nijveldt (W.). **Galmuggen van cultuurgewassen. II. Galmuggen, schadelijk voor de groenteteelt in Nederland.** [Gall-midges on cultivated Plants. II. Gall-midges injurious to Vegetable Crops in Holland.]—*Tijdschr. PlZiekt.* **59** pt. 3 pp. 77–81, 5 figs., 4 refs. Wageningen, 1953. (With a Summary in English.)

The Cecidomyiids dealt with in this part of a series [*cf. R.A.E.*, A **40** 359] are those that attack vegetables in Holland and comprise *Contarinia pisi* (Winn.) on peas and *C. nasturtii* (Kieff.) and *Gephyraulus raphanistri* (Kieff.) on crucifers. The bionomics of the three species and the damage caused are described, their alternative food-plants and distribution are reviewed, and the characters of the genus *Gephyraulus*, which is close to *Dasyneura*, are summarised.

Stokes (B. M.). **The Host Plant Range of the Swede Midge** (*Contarinia nasturtii* **Kieffer**) **with special Reference to Types of Plant Damage.**—*Tijdschr. PlZiekt.* **59** pt. 3 pp. 82–90, 2 pls., 2 figs., 4 refs. Wageningen, 1953. (With a Summary in Dutch.)

Leefmans (S.). **Enige notities naar aanleiding van het artikel van Miss Barbara Stokes.** [Notes on the Article by Miss Barbara Stokes.]—*T.c.* pp. 91–94. (With a Summary in English.)

Following investigations in England in 1950–51, in which it was found that *Contarinia nasturtii* (Kieff.) had a large number of hitherto unsuspected food-plants and confirmed that females from flowers or leaves oviposit on either plant part [*cf. R.A.E.*, A **38** 378; **40** 190], further tests were made in Holland in 1952. They are described in the first paper. Cruciferous plants were grown in an infested plot in Amsterdam, and galls containing full-grown larvae were collected from them and placed on peat in emergence cages that are described. The adults that emerged were used

in breeding experiments on plants enclosed in muslin bags. Four types of injury were observed, namely, closed, swollen flower buds (bell-flowers), inflorescence galls, in which the flowering head consisted of small buds with very short or no peduncles and a very short axis, crinkling and puckering of the leaf tissue, and swelling at the base of the leaf stems and axils. Several types of injury were sometimes seen on one plant. The types observed on crucifers of 15 species in the experimental plot and on crucifers in other areas are shown in tables, and several previously unknown as food-plants in Holland are recorded.

It was found that adults reared from flowers paired with others from leaves and from inflorescence heads of different plants. Examples reared from leaves caused injury of all four types, those from inflorescences infested leaves and inflorescences, and those from individual flowers caused inflorescence and flower galls and were seen to oviposit on leaves. No infestation resulted when females from the leaves of rape were caged on red cabbage or swede in leaf, those from radish flowers were confined on swede or *Brassica alba*, and those from cauliflower bell-flowers were caged on cauliflower, red cabbage, swede or *Isatis tinctoria* in the leaf stage. Adults from inflorescences of *Eruca sativa* did not breed on radish, nor those from *Lepidium sativum* (garden cress) on red cabbage.

When females reared from leaf shoots of rape were transferred successively from one food-plant to another, one oviposited on the sepals and inflorescence axis of *E. sativa*, at the base of the leaves of swede, among buds of *L. sativum* and at the base of the leaves of *I. tinctoria*. The optimum temperature for oviposition was apparently about 22°C. [71·6°F.], the upper and lower limits being 16 and 26°C. [60·8 and 78·8°F.], respectively.

It is concluded that *C. nasturtii* has a wide range of cruciferous food-plants and readily changes from one to another. The possibility of the existence of a race restricted to bell-flower galls and living side by side with others capable of oviposition also on other parts of the plants should be considered, but experimental evidence and field observations suggest that the type of gall formed depends on the stage of plant growth at the time of oviposition. Galls were not found on the leaves when young flowers were available, or on open mature flowers, and very rarely on large, old leaves.

It is pointed out in the second paper that the formation of galls of several types by a single species throws doubt on the older method of classifying Cecidomyiids according to the gall formed. The control of *C. nasturtii* on cabbage in Holland was investigated in 1936–38 [**27** 514, etc.], and it was then observed that females from bell-flowers on radish did not oviposit on cauliflower or red cabbage in leaf, and that leaf shoots of rape were heavily infested although adjacent radish in flower was not. The existence of biological races differing in their preferences for food-plants and plant parts is considered possible.

Forsøg med bekaempelse af paeregalmiden ved hjaelp af metylbromid. [Experiments on the Control of *Eriophyes pyri* by Means of Methyl Bromide.]—*Medd. Forsøgsv. PlKult.* no. 498, [2] pp. Copenhagen, 1953.

In experiments in Denmark in November 1950 and March 1951, fumigation with methyl bromide at about 1 lb. per 1,000 cu. ft. for six hours or about 2 lb. for four hours at temperatures of 20–25°C. [68–77°F.] gave complete control of *Eriophyes pyri* (Pgst.) on heavily infested nursery pear stock two years old, with no injury to the trees.

Endrigkeit (A.). **Weitere Versuche zur vorbeugenden Bekämpfung der Kohlfliege (*Chortophila brassicae* Bché.) bei Kohlsetzlingen mit Kontaktinsektiziden im Wurzeltauch- u. Saatbeetbegiessungsverfahren.** [Further Experiments on the preventive Control of *C. brassicae* on Cabbage Seedlings with Contact Insecticides by Root Immersion or watering Seed Beds.]—*Z. PflKrankh.* **59** pt. 7–8 pp. 248–255, 11 refs. Ludwigsburg, 1952. (With a Summary in English.)

An account is given of further tests in Schleswig-Holstein in 1951 on treatments for the protection of cabbage seedlings from infestation by *Hylemyia* (*Chortophila*) *brassicae* (Bch.) [*cf. R.A.E.*, A **42** 196]. When the roots were immersed in water or clay and water to which proprietary insecticidal preparations were added, BHC emulsion concentrates were phytotoxic and gave less durable protection than wettable powders, which were more effective in clay and water than in water alone. DDT powders or emulsion concentrates and a derris emulsion were unsatisfactory in either medium, and mixed powders of BHC and DDT gave varying results. Watering the plants in the seedbed with an emulsified solution of BHC 12 hours before transplanting was ineffective.

Buhl (C.). **Der grosse Kohltriebrüssler (*Ceuthorrhynchus napi* Gyll.), ein bisher im Glückstädter Gemüseanbaugebiet unbekannter Schädling.** [*C. napi*, a hitherto unknown Pest in the Vegetable-growing Area of Glückstadt.]—*Z. PflKrankh.* **59** pt. 9–10 pp. 326–334, 3 figs., 8 refs. Ludwigsburg, 1952. (With a Summary in English.)

In May 1950, adults and larvae in all stages of *Ceuthorrhynchus napi* Gylh., which had not previously been recorded so far north as Schleswig-Holstein, were found to be common on cabbage grown for seed near Glückstadt, north-west of Hamburg. Few adults were present at the beginning of June, during the flowering period, but there were up to 86 larvae per plant. About 60 per cent. of the plants were infested, and rape was scarcely at all attacked.

The following spring was exceptionally cold. Adults were first observed on the plants on 19th April, and eggs were found on 4th and larvae on 7th May, after which the adults soon disappeared. When the cabbage began to flower, the larvae entered the soil for pupation, and adults were observed in the cocoons on 19th July. Infestation of rape was again light. The only parasite observed was *Thersilochus gibbus* Hlmgr., which attacks the larvae, but it was not common.

The principal injury to the plants was due to the pathological effects of oviposition [*cf. R.A.E.*, A **40** 323] and to the damage caused by the larvae mining in the stalks, which rendered the plants susceptible to attack by *Alternaria* sp. Dusting with BHC or a parathion-type insecticide at intervals of six days in spring, when the adults were migrating to the plants, gave good control.

Arenz (B.) & Schröppel (H.). **Über die Auswirkung einer Cyanamidernährung von Kartoffelpflanzen auf den Besatz mit Kartoffelkäferlarven.** [On the Effect of Cyanamide fed to Potato Plants on Infestation by Larvae of the Potato Beetle.]—*Z. PflKrankh.* **59** pt. 9–10 pp. 334–339, 4 graphs, 5 refs. Ludwigsburg, 1952. (With a Summary in English.)

In view of numerous reports in the German literature that calcium cyanamide applied as a fertiliser to potatoes reduces infestation by the potato beetle [*Leptinotarsa decemlineata* (Say)] [*cf. R.A.E.*, A **33** 158, etc.], laboratory tests were carried out in which potato plants in pots were allowed to stand in aqueous solutions of almost pure cyanamide (nitrogen content

66 per cent.) at concentrations giving 0·1–0·4 per mille nitrogen. First-instar larvae of *L. decemlineata* were placed on the leaves when the plants were transferred to the solutions, and larval mortality was noted at intervals for about a week.

Two varieties of potato were used, and the cyanamide had a harmful effect on both, particularly at the higher concentrations, though one variety was less injured than the other, but these effects disappeared in all cases except one when the pots were transferred to plain water at the end of the experiments.

Four series of tests were carried out, and in two of them any possible fumigant effect of the cyanamide was excluded by allowing one of the leaves to rest on a glass plate and enclosing the larvae on it with an inverted petri dish. The larvae fed on the leaves of all the plants, but the amounts consumed decreased with increasing nitrogen concentration. Increased mortality of larvae on the experimental plants was observed after 24 hours, and the mortality percentages after a week averaged 34·4 in the controls (water only) and 70·2, 94·5 and 96·7 for 0·2, 0·3 and 0·4 per mille nitrogen, respectively. There was only a slight increase in mortality for larvae on plants standing in 0·1 per mille nitrogen solution, and this concentration was omitted after the first series of tests. Enclosing the larvae with the petri dishes did not affect mortality, except in the controls.

From a discussion of these results, it is concluded that the cyanamide was absorbed by the roots of the plants and translocated to the leaves, rendering them temporarily toxic.

Goossen (H.). **Zur Feststellung und Bedeutung der Spritzbrühverteilung im Kartoffelbestand.** [The Determination and Significance of Spray-liquid Distribution in Potato Fields.]—*Z. PflKrankh.* **59** pt. 9–10 pp. 339–353, 7 figs., 6 refs. Ludwigsburg, 1952. (With a Summary in English.)

In field tests in Germany, the distribution of sprays on potatoes afforded by spraying apparatus of various types was studied by covering both surfaces of leaves on various parts of sample plants with paper and covering the soil round others with paper collars, the deposits on the papers being subsequently compared. The spray, which usually consisted of coloured water only, was applied at about 13·5–54 gals. per acre. None of the apparatus tested gave adequate coverage of both leaf surfaces. Coverage of the undersides was normally poor, but was improved at the higher rates of application and was best when a metal bar was used to bend the plants over during spraying, though coverage of the upper surfaces suffered as a result. High rates of application gave greater deposits on the lower leaves, but more of the spray dripped from the plants and was lost. In tests with toxicants at equal rates per acre, a fungicide (against *Phytophthora infestans*) gave the maximum control when applied in the greatest quantity of liquid tested, but an insecticide applied against *Leptinotarsa decemlineata* (Say) was most effective in the minimum amount (18 gals. per acre), since the adults and larvae congregate near the tops of the plants and coverage of the lower leaves is superfluous.

Schaerffenberg (B.). **Die Möglichkeiten einer Maikäferbekämpfung mit Hilfe von Mykosen. I. *Beauveria densa* Link, ein Hauptparasit von *Melolontha* sp.** [The Possibility of controlling Cockchafers with the Aid of Mycoses. I. *B. densa*, a principal Parasite of *Melolontha* sp.]—*Anz. Schädlingsk.* **25** pt. 11 pp. 166–170, 4 graphs, 14 refs. Berlin, 1952.

An account is given of experiments in Austria in which plots of poor sandy soil and soil rich in humus were surrounded with wire netting to a

depth of 8 ins., infested with healthy larvae of *Melolontha* sp. in different instars in June 1948 and watered at the end of the month with a suspension of spores of the entomophagous fungus, *Beauveria densa*. The larvae were examined each month until October and infected ones removed; these were ground up at the end of the season and returned to the soil. Further healthy larvae were added in June 1949 and 1950 and observed as before, infected ones being redistributed in October 1949. The mortality obtained in the three years is shown on graphs. It was highest in September and averaged 72, 19 and 24 per cent., respectively, in the three seasons for the sandy soil and 90, 85 and 88 per cent., respectively, for the rich soil. The humidity of the two types of soil in each year is discussed, and the high mortality in 1948 in the sandy soil is attributed to exceptionally heavy summer rain. The conclusions drawn from earlier laboratory experiments [*R.A.E.*, A **31** 376] are confirmed, and the addition of organic matter to poor soil is considered essential for successful biological control by means of this fungus.

Dosse (G.). **Versuche zur Bekämpfung von Kohlschädlingen** (*Chortophila brassicae* **Bché und** *Blaniulus guttulatus* **Bosc.).** [Experiments in the Control of Cabbage Pests (*Hylemyia brassicae* and *B. guttulatus*).]—*Anz. Schädlingsk.* **26** pt. 1 pp. 6–9, 1 fig., 4 refs. Berlin, 1953.

In view of complaints from growers near Stuttgart that a proprietary mercury preparation widely used against *Hylemyia* (*Chortophila*) *brassicae* (Bch.) on cabbage was proving ineffective, even at almost double the normal concentration, investigations were carried out in 1952. These showed that the millepede, *Blaniulus guttulatus* (Bosc), was also present, and injury by it had been mistaken for that due to the fly, which is very similar [*cf. R.A.E.*, A **41** 35]. In tests in which the plants were watered with the mercury preparation and one containing BHC, the first gave good control of *H. brassicae* but not of *B. guttulatus*, whereas the second was toxic to both. The most economical treatment resulted when the BHC preparation was added to the water given to the seedlings when they were planted out and applied again about ten days later.

Stübner (K.). **Ein fluoreszenzoptisches Verfahren zum Nachweis von Hexa und DDT.** [A fluorescent optical Procedure for the Detection of BHC and DDT.]—*Anz. Schädlingsk.* **26** pt. 1 pp. 9–12, 3 figs., 3 refs. Berlin, 1953.

The author's method for the fluorescent microscopic detection of DDT [*R.A.E.*, A **42** 69] cannot be applied directly to BHC in an inert carrier, since BHC is not sufficiently fluorescent to be easily distinguished from the other components. It can be used, however, if the BHC is first treated with a fluorescent stain. This is done by mixing the BHC with 0·2–1 per cent. of its weight of stain, heating to melting point, stirring and cooling, followed by recrystallisation and grinding of the BHC. Experiment is necessary to establish the exact proportion of stain required. This treatment also improved the results with DDT [*cf. loc. cit.*]. Tests were carried out with DDT and various grades and isomers of BHC, and tables are given showing suitable stains and light filters for each, together with the colours obtained.

Rademacher (B.). **Krankheiten und Schädlinge im Acker- und Feldgemüsebau, ihre Erkennung und Bekämpfung.** [Diseases and Pests in Agriculture and Market-gardening, their Identification and Control.]—*Schr. neuzeitl. Landb.* **12,** 2nd revd. edn., 9 × 6¼ ins., 261 pp., 3 col. pls., 126 figs., refs. Ludwigsburg, E. Ulmer, 1954. Price, boards, *DM.* 11.80; cloth, *DM.* 13.

The second edition of this handbook on pests and diseases of field and vegetable crops in Germany retains the general character and arrangement of the first [*R.A.E.*, A **37** 319], but the number of pests dealt with has been increased, and the section on chemical control considerably augmented.

Pingale (S. V.), Narayana Rao (M.) & Swaminathan (M.). **Effect of Insect Infestation on stored Grain. I. Studies on soft Wheat.**—*J. Sci. Fd Agric.* **5** no. 1 pp. 51–54, 16 refs. London, 1954.

The results are given of investigations in India on the physical and biochemical changes in grain that result from infestation by *Calandra oryzae* (L.), *Trogoderma granarium* Everts and *Ephestia cautella* (Wlk.). Samples of soft wheat with an initial moisture content of 10·32 per cent. and a viability of about 89·7 per cent. were infested with adults of one species, stored at a temperature of 78–84°F. and 48–62 per cent. relative humidity for about six months and examined once a month. *Calandra* reduced the weight but not the total volume of the grain, whereas *Trogoderma* and *Ephestia* reduced both weight and volume. The first two both reduced viability, but less so than *Ephestia*, which feeds only on the germ. *Calandra* multipled much more rapidly than the other species and added more impurities and body fragments to the grain. Insect damage caused an appreciable increase in the acidity of the fat and a decrease in the thiamine content, but had no significant effect on other constituents of the grain, such as total nitrogen and reducing sugars.

Papers noticed by Title only.

Sarles (M. P.) & Vandegrift (W. B.). **Chronic oral Toxicity and related Studies on Animals with the Insecticide and Pyrethrum Synergist, Piperonyl Butoxide.**—*Amer. J. trop. Med. Hyg.* **1** no. 5 pp. 862–883, 1 graph, 9 refs. Baltimore, Md., 1952. [See *R.A.E.*, B **42** 105.]

Weidner (H.). **Bestimmungstabellen der Vorratsschädlinge und des Hausungeziefers Mitteleuropas.** [Keys to the Store Pests and Household Vermin in Central Europe.]—2nd revd. edn., 9¾ × 6¾ ins., viii + 234 pp., 272 figs., refs. Jena, G. Fischer Verlag, 1953. Price *DM.* 14.50. [*Cf. R.A.E.*, A **26** 196.]

Smart (J.). **Instructions for Collectors No. 4a. Insects. Revised by W. E. China.**—3rd edn., 6¾ × 4¾ ins., x + 178 pp., 43 figs. London, Brit. Mus. (Nat. Hist.), 1954. Price 3*s.* 6*d.*

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Boletín de la Dirección de Estudios Biológicos (Mexico): Tomos 1–2 (1924–25).
Bollettino della Società Italiana di Biologia Sperimentale (Naples): Vols. 17 (1942) Nos. 5–6; 18–21 (1943–45).
Buletinul Societatii Naturalistilor din România (Bucarest): Nr. 1–7, 14 et seq.
Buletinul Societatii de Stiinte din Cluj (Cluj): Tomul 9 fasc. 3.
Bulletin Agricole de l'Algérie-Tunisie-Maroc (Algiers): Année 20 (1914) Nos. 7–9, 12–14.
Bulletin du Comité d'Études Historiques et Scientifiques de l'Afrique Occidentale Française (Paris): Année 1919 No. 1.
Bulletin Économique Mensuel, Madagascar (Tananarive): Nos. 85 (1933), 87 (1934).
Bulletin Économique Trimestriel, Madagascar (Tanararive): Nos. 11–14 (1937–38).
Bulletin de l'Institut des Recherches Biologiques (Perm): Tome 1 (1923) fasc. 1–2.
Bulletin de l'Institut de Zoologie Appliquée et de Phytopathologie (Leningrad): Vols. 6 (?1935) Nos. 1–2; 9–11 (?1940).
Bulletin du Musée du Caucase (Tiflis): Tome 9 (1915) livr. 1.
Bulletin de la Station Régionale Protectrice des Plantes à Leningrad: Vol. 6 (?1927); 7 (1936) No. 2.
Bulletin of the Stoneham Museum (Kitale): Nos. 37, 41.
Canadian Insect Pest Review (Ottawa): Vol. 25 (1947) No. 1.
Caribbean Forester (New Orleans, La.): Vol. 1 (1940) No. 1.
Chacaras e Quintaes (São Paulo): Indices to vols. 10, 11, 12, 14; 42 (1930) No. 3.
Chinese Medical Journal (Chengtu): Vol. 61A (1942) No. 1.
Choroby Roślin (Warsaw): T.1 cz.1 (1931).
Comptes Rendus des Séances de l'Académie d'Agriculture de France (Paris): Tome 8 (1922) No. 5.
Comptes Rendus de l'Académie des Sciences de l'URSS (Moscow): (N.S.) Vols. 20 (1938) No. 4; 23 (1939) No. 6; 26 (1940) Nos. 8–9; 27 (1940) Nos. 1–7, 9; 28 (1940) No. 1; 33 (1941) Nos. 4–6; 41 (1943) Nos. 8–9; 44 (1944) Nos. 4–9; 45 (1944) No. 1; 48 (1945) Nos. 4–5; 54 (1946) No. 9; 55 (1947) No. 7; 56 (1947) No. 2.
Cyprus Agricultural Journal (Nicosia): Vol. 23 (1928) Pt. 3.
Deutsche Entomologische Zeitschrift "Iris" (Dresden): Bd. 53 (1939) Nos. 2–4; 54 (1940); 55 (1941).
Dokladÿ Akademii Nauk SSSR (Moscow): (N.S.) Vols. 57–58 (1947).

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